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THE BARKBEETLE PROBLEM IN EUROPE AND NORTH AMERICA

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The primary rôle played by scolytid barkbeetles as pests of coniferous crops in Europe and North America is a recurrent feature of forest insect literature. It is also well known that the factors favouring multiplication of these insects to epidemic proportions, originate from such primary causes as overmaturity of the crop, disturbances of the environmental balance by adverse weather conditions such as drought or catastrophic destruction by storms, heavy damage by insect defoliators, and lastly, damage caused by the stress and neglect of war.

A survey of literature over the past 40 years shows that while the origins and details of barkbeetle attacks in Europe and North America may differ, the general aspects of the situation, examined on broad lines, bear great resemblances to one another. One can also see that the modern views on the question of prevention and control of such attacks have many points in common in both hemispheres, running as they do, increasingly along silvicultural lines. A brief review of these problems may, then, have valuable lessons for foresters in Great Britain, and other parts of the world where coniferous planting is in progress on any considerable scale.

European Barkbeetle Outbreaks, 1919-49.

After the 1914-18 war, barkbeetle outbreaks arose in several parts of Europe. Hubault [1], describes one which began in 1920 in the Munster valley (Haut-Rhin) of the Alsatian Vosges. Spruce and Silver Fir were the worst affected species, the principal barkbeetles being *Ips typographus* and *curvidens* in a primary rôle, with *Pityogenes chalcographus* and *Polygraphus poligraphus* as secondaries.

Describing conditions at the time of the outbreak, the author cited the war as the chief cause of the insect increase, inasmuch as it had not only caused material destruction, but had hindered the progress of routine forestry work, resulting in untended woods which became an easy prey to the beetles. For immediate relief, he advocated the concentrated use of trap stems, and as a long-term policy, revision and improvement of current silvicultural methods. He made a study of the natural enemies of the beetles, amongst which he thought the activities of the fungi and bacteria associated with them were worthy of closer study with a view to their possible future economic use.

About the same time (1919-23), Kautsch [2] described an attack of *I. typographus* in the Reichraming valley, Austria. Here, 25.5 million cu. ft. of overmature Spruce were ruined. The area was cleared at great cost and replanted with pure Spruce, a policy that was criticized by Karl Fritz in a note on Kautsch's paper, in which he advocated establishing mixed stands. In 1931-32, three great storms caused severe damage to large areas of Spruce and Pine in central and southern Sweden, and in 1935 Trägårdh and Butovitsch [3] published a detailed account of measures taken to deal with the situation. *I. typographus* and *Myelophilus piniperda* were the principal species, with *Pityogenes* and *Polygraphus* as accessories. Butovitsch published another paper on the same subject in 1940 [4], and from these works several interesting features emerge. Firstly, the 'strip-survey' method devised by the authors to study densities of barkbeetle population in different areas; secondly, the question of prompt removal of the fallen timber in such areas where it could be effected, and damage thus considerably reduced; and thirdly, the best methods of setting trap logs and of

stacking timber in the forest in places where prompt removal was impossible. Butovitsch showed that continuation of attack was directly affected by rate of removal of fallen trees, the principal species, *I. typographus*, showing a static phase in which attack was confined to fallen stems, followed by a dynamic phase when migration occurred and centres of infestation shifted. He found that the major outbreaks ended after a 5-year period, while the minor ones ended after 2 years. In 1939 Trägårdh [5], investigating damage caused by another severe storm in the N. Norbotten region of Sweden, when 750,000 trees were thrown, found entomological conditions such as to justify leaving the timber lying until autumn, thus avoiding useless expense in attempting immediate clearing up of the areas concerned.

In 1939, Thomsen [6] described attacks by *Pityogenes chalcographus*, normally considered of secondary importance, on young Spruce and Douglas Fir in Denmark. The damage was particularly severe in 1938, when 90% of the trees were either killed or badly injured. The primary cause of attack was traced to abnormal spring weather causing premature growth, followed by late frost which caused 'frost rings' to develop in the active cambium. The majority of the trees died, however, not from frost damage but from beetle attack while in a weakened state. *P. chalcographus*, is again referred to as a species of growing importance by Galoux [7] in 1947. He describes it as a polewood pest, attributing its increase on the Continent to the spread of Spruce cultivation. He recognizes the customary secondary status of the insect, but states that under Continental conditions it may become epidemic in plantations which have been weakened by other factors, usually physiological.

During the second world war, and immediately after its close, the primary species, *Ips typographus*, again appears in the literature. Schimitschek [8] in 1940 described a severe outbreak which had lasted for 10 years in the Turkish Black Sea region of Trebizond. He urged the efficient and prompt use of trap logs, and the establishment of mixed stands with Spruce predominating. In 1947, Kurir [9] reports the same species on an area of 1,000 ha. in the St. Valentin and Amstetten districts of Austria, and Schneider-Orelli [10] describes widespread attacks on the Swiss plateau. The Austrian attack originated directly from war damage, and while some success was claimed from the use of calcium arsenate as a chemical control, Kurir thinks trap trees more efficacious, plus a more modern type of insecticide. Schneider-Orelli ascribes the Swiss attacks primarily to exceptionally favourable weather conditions in the summer and spring of 1945-46, together with the lack of normal forest tending owing to war conditions, which resulted in large numbers of stems being left unbarked. He also states that many adult beetles leave their galleries in autumn to hibernate in the soil cover, and found this habit prevalent in places where barking of trap stems had been carried out, and also where no trees had been felled. He recommends trap stems, which should be barked over sheets placed on the ground, the bark being immediately burnt. He also suggests the application of a poison spray to the soil, and on the tree trunks to paralyse adults that escape. All traps must be in place by the end of March, and to prevent beetles leaving stems to hibernate, barking and burning should be completed by the end of September.

An attack of *I. typographus* and *curvidens*, in Silver Fir and Spruce, was described by Aubert [11] in the Selestat-Ville region of the Alsatian Vosges in 1946-47. Unsuitable site conditions originated this attack, the region being one of the driest in the Vosges, and he recommends the substitution of Scots Pine for Silver Fir on the lower slopes, a mixed stand of Scots Pine and Beech being preferred to Silver Fir elsewhere.

The Landes region of France also suffered heavy damage as a result of the war. A report [12] published by the Nancy school of forestry in 1947, estimated that 30% of the area had been destroyed by fire, with resulting insect invasion. The latter included two *Ips* species, *Pityogenes bidentatus*, both species of *Myelophilus*, the weevils *Hylobius* and *Pissodes*, and a longhorn, *Monohammus galloprovincialis*, which was causing considerable damage to the timber. Intensive trapping, recommended as the only possible measure, included stump barking which much increased the cost of the operation. It was also proposed to enforce the barking order on all forest produce between March and October and to prohibit thinning of young Pine woods during the growing season.

Barkbeetle Outbreaks in the United States and Canada, 1890-1949.

Despite the vast territory concerned and the multiplicity of coniferous species involved, the bark-beetle situation in N. America can be reviewed in the following general terms. The primary species

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belong to the genus *Dendroctonus*, followed, and in a few instances preceded, by species of the genera *Ips*, *Dryocoetes*, etc., and buprestid woodborers. The distribution of the *Dendroctonus* species is roughly as follows:—*D. piceaperda*, the eastern Spruce barkbeetle, in the eastern United States and Canada, *D. frontalis*, the Southern Pine beetle, in the central and southern United States, *D. ponderosae*, the Black Hills beetle, in S. Dakota and neighbouring regions, *D. monticolae* and *brevicomis* in the western States and Canadian Pacific coast, and *D. engelmanni*, the Engelmann Spruce beetle, in the same region. Craighead [13] has recently summarized the enormous losses caused by some of the above species over the past half-century. In the years 1890–92, the Southern Pine beetle killed a large % of the Pine and Spruce over an area of 75,000 sq. miles in the states of Virginia and Maryland. In a 10-year outbreak (1895–1905), the Black Hills beetle destroyed over 1,000 million bd. ft. of timber in S. Dakota, and was also responsible for the loss of some 300 million bd. ft., 12% of the entire timber stand, in N. Arizona between 1917 and 1926. In the western forests, *D. monticolae*, attacking the Lodgepole Pine of the Bitterroot valley, N. Rocky Mountains, destroyed 7,250 million bd. ft., representing some 30 million trees. Craighead calculates that over the whole area of the U.S.A., the annual barkbeetle mortality amounts to 2,800 million bd. ft., a figure which should be set against the 4,400 million bd. ft. of lumber produced by all the western sawmills, and the 1,400 million bd. ft. of timber destroyed by fire in the entire U.S.A. during the year 1936. These insect outbreaks, he states, are often more important for the fire danger they create than on account of the timber value they destroy. He also emphasizes the great damage caused by them to scenic and forest-protection values in national parks and game reserves.

Some individual examples of these outbreaks are worthy of record. Evenden and Gibson [14] in 1940 recorded a destructive outbreak of the mountain Pine beetle in Lodgepole Pine stands of the Beaverhead National Forest, Montana. This lasted from 1924 to 1936, killing over 57,000,000 trees over 3 in. in diameter. The authors pointed out the great fire hazard this destruction had left behind, and pleaded for an organized system of permanent forest surveys to collect data on the origin of outbreaks, thus enabling timely measures to be taken. *D. piceaperda*, the eastern Spruce barkbeetle, was the subject of a controversial paper by Gobeil [15] in 1941. He discussed the question whether this species was to be regarded as detrimental or beneficial, dealing with losses caused by its attacks in the Gaspé area of Quebec. He concluded that the method of estimating losses in round figures is misleading, since very little monetary value can be placed upon the dead material. He admitted that the attack had given rise to an unfortunate situation in the Gaspé, but considered that if it had focussed thought and action upon better forest management, the beetle would be worth more to foresters than all the timber destroyed by it. He emphasized the point that the beetle had concentrated upon the overmature Spruce stands, and concluded that the situation could only be remedied by better forest management. In the following year, Balch [16] replied to this paper, pointing out that studies in certain parts of the Gaspé peninsula had shown that the attacks of the beetle plus those of the European Spruce sawfly, had actually caused the destruction of the greater part of a Spruce stand of a most stable type, producing the highest yield per acre, and on the most accessible site. The effects of this cannot be measured by a simple calculation of the volume of dead wood. Operation costs have increased over the whole area and deterioration has begun throughout the stand, which will result in a large part being unfit for profitable working. Fire hazard has also increased, and it is doubtful whether 70 years will see the full replacement of the stand. Under epidemic conditions, this barkbeetle does not confine its attentions to overmature stands, being able to destroy a large part of the merchantable volume of valuable Spruce forest, especially White Spruce, and also to cause undesirable changes in stand composition.

Finally, while he agrees that management of Spruce forests on a rotation of 100 years or less would probably eliminate outbreaks, he does not consider this any reason for regarding with complacency the depletion of older stands on which the logging industry relies for its future wood supply. S. A. Graham, commenting upon these two papers makes the following observations. Citing Gobeil's statement that over the whole of Canada there is sufficient standing timber to meet industrial needs, despite insect loss, and therefore from a national viewpoint, this loss in the Gaspé is not truly an economic one, he remarks that this may seem logical from a national angle, but the author neglects the fact stressed by Balch, that while there may be a national surplus, it may not be immediately accessible, or indeed, available for the use of particular business concerns, dependent

upon specific timber stands. This loss is very real to the companies concerned, regardless of any overall surplus existing elsewhere.

These two papers show the ever-increasing tendency and need to seek for a silvicultural solution of the insect problems facing the North American forester.

During the period, 1943-45, several papers of great interest have appeared dealing with outbreaks of *Dendroctonus* on western coniferous species. Evenden, Bedard, and Struble [17], discussing the activities of the mountain Pine beetle (*D. monticolae*), record it as an important enemy of the valuable Sugar Pine, of which it destroys many million board feet of timber in epidemic years. It is also destructive in national park areas. Where valuable stands are destroyed, the loss is often irreparable in the sense that the succeeding crop is all too often composed of inferior species. The beetle has considerable migratory powers, spreading across treeless areas, 15 to 20 miles wide, either by flight or windborne. Its distribution is extensive, ranging from British Columbia to S. California, with annual generations varying from 1 to $1\frac{1}{2}$ in the north, to two and sometimes a partial third, in the south.

In 1944 Prebble [18], discussing the place occupied by insects in the forest economy of Canada, with special reference to the Pacific Coast region, estimated that, over a 31-year period, the annual depletion of stands by barkbeetle and defoliator attack amounted to 3.6%, against a loss of 10.7% by fire. He considers the % generally allotted to insect loss as too low, since it does not include losses from insects whose damage cannot so readily be assessed, but which may be as important as, or more so than, those quoted. As regards insect conditions in British Columbia, he states that control of the barkbeetle situation in the Western Yellow Pine (*P. ponderosa*) areas is being conducted on a management basis, but that in the Lodgepole Pine areas plans for handling the situation are still in an experimental stage. Referring to Spruce budworm attacks, he describes one in a mixed stand of Western Balsam and Spruce, which was followed by invasion of the barkbeetles, *Dryocoetes confusus* on Balsam, and *Dendroctonus engelmanni* on Spruce, and a mortality of 80% of the Balsam and 10% of the Spruce. He recommends further study of a method of silvicultural control used in the eastern states, which aims at reducing the % of Balsam in mixed stands, as a check on budworm increase.

The Southern Pine beetle (*D. frontalis*) was studied from a similar silvicultural viewpoint by Hoffman and Anderson [19] in 1945. Examining relationships between timber losses and natural restocking, they concluded that although in recent years the Pine forests of the southern states have been relatively free from epidemic attacks, studies carried out on one area when the insect was in an endemic state showed firstly, that the Pines in pure stands suffered more from insect attack than when mixed with hardwoods; and secondly, that the openings in the stand caused by beetle attack were being restocked, for the most part, by hardwoods of an inferior type.

Climatic Factors and Barkbeetle Outbreaks.

Craighead cites drought as a primary cause of tree susceptibility to barkbeetle attack. In 1924, rainfall deficiency of 15 in. between June and January produced this condition in Louisiana and Texas, and over large areas 3 species of southern Pine were killed following sharp, local droughts. In 1925, it was also shown that this mass attack depended upon moisture deficiency, and ended once normal rainfall ensued. In 1932, Cary recorded a seven-months drought in Florida and Georgia, when the climatic effect was primary, and associated insects secondary. Studies by Hall (1938-41) at the field station, Berkeley, California, including examination of insect records and timber losses covering many years, revealed close connexion between climate, past timber losses, and insect abundance. In 1941, Eaton [20] showed that on the old burns and cut-over areas of N.E. California, where a mixture of *P. ponderosa* and *Abies concolor* had replaced the original crop, mountain Pine beetle had almost killed out the Pine. Severe competition, aggravated by prolonged drought, had caused reduced growth, low vigour, and beetle attack. Beal [21], investigating the relationship between tree growth and outbreaks of the Black Hills beetle, studied 13 attacks covering a 44-year period (1895-1939) in S. Dakota, Colorado, Utah, and Wyoming. Nine of these began and were built up in periods of low rainfall and subnormal growth. Two began in wet years, but apparently increased in vigour during years of only slight rainfall deficiency with comparatively slight growth reduction; while the last two began and continued under the latter conditions. Artificial control ended the most recent outbreaks, masking the effect of natural limiting factors. Nine outbreaks ceased when growth was

on the increase, and four when it was below normal. The author concluded that while epidemic conditions often occur during periods of poor growth, they also arise when conditions are reversed. Drought, age, or stagnation through silvicultural causes, may change an endemic to an epidemic condition. The factors to be studied, therefore, are those which may constitute primary causes of outbreaks arising at times of normal rainfall and growth. In Canada, the recent studies of Hopping and Mathers [22] on the mountain Pine beetle (*D. monticolae*) attacking Lodgepole Pine in British Columbia, have shown that the attack in the Banff area was only one of a series affecting eastern British Columbia during the period 1920-45 and destroying much timber. They consider rainfall the most important primary factor, and state that Lodgepole Pine will only flourish in places where the average rainfall is at least 18 in., and over 21 in. for the best conditions. The Banff region has suffered rainfall deficiency for over 20 years, causing marked growth reduction in trees of all ages. Artificial control has been started, and will be kept up until a wet spell brings back normal growth, which will require an 18-in. annual rainfall for several seasons. This problem can only be solved, in their opinion, by changing the stand composition, gradually removing a large % of the Lodgepole Pine, and inducing mixture. To leave things as they are, is to ensure further attacks when conditions favour reduction of tree growth.

Natural Enemies of Barkbeetles.

Galoux [23] has recently discussed in some detail the animal complex which, as parasite or direct predator, groups itself round the barkbeetles. This fauna varies in quality according as conditions are those of primitive forest, forest approaching a climax stage, or artificial plantations of one or two species. The author notes the increasing attention that is being paid to the study of this fauna, and the search for some practical method of increasing its value at times of stress, and he draws an interesting comparison between the complex as it exists in Europe and in North America. It is not yet clearly established that the forester can help in any way towards increasing the efficiency of the natural enemies by artificial means. Karpinski [24], studying *Ips typographus* and *duplicatus* in Poland, forecast that their future control would be effected by co-operation between the forester and the natural control agents present. He listed the following factors as most important—(a) Overcrowding of broods in the larval stage. (b) Activities of small barkbeetles of the genus *Crypturgus*. Their galleries adjoin those of the larger species and they are reputed to destroy numbers of their eggs. (c) Woodpeckers. (d) Insect parasites and predators. (e) Nematodes, fungi, bacteria, etc.

Discussing the part played by these natural enemies, the author believes that foresters can translate his theories into practice by manipulating thinning, barking, and trapping methods, to encourage their increase, and make them a decisive influence on barkbeetle numbers. This idea of manipulating thinnings, and other methods of encouraging and conserving natural enemies, formed the basis of Hanson's work [25] on the ecology and control of *Myelophilus piniperda*, the Pine shoot beetle. Hanson described a number of important parasites and predators of this species, and regarded the nitidulid beetles of the genus *Rhizophagus* as by far the most important, much more so, indeed, than the clerid *Thanasimus formicarius*, which he considered a menace to the parasites also doing good work in destroying the barkbeetle broods. He found parasites and predators at their greatest concentration in young, unthinned polewoods, at which stage he considered the barkbeetles were biologically controlled. Large-scale thinning experiments performed to study the relationship between the barkbeetles and their natural enemies, showed that it was desirable to defer the first thinnings of Scots Pine until the combined adverse effects of brood overcrowding and biological control weakened. This occurs when the amount of suitable breeding material, in the form of suppressed trees, satisfies the minimum needs of an increasing resident population, and may happen at different ages not only in different localities, but at various points of the same locality. The author worked with 20- to 30-year-old plantations, thinning in strips, and leaving the thin-barked material of small diameter on the ground to maintain a permanent population of natural enemies.

Efforts to promote the usefulness of such control agents have also been made in the United States. Person [26] studied the clerid *Thanasimus lecontei*, a predator on the western Pine beetle. He found that when the clerid larvae averaged 18 per square foot of bark, barkbeetle mortality was three times as great as when clerids were absent. Application of the solar heat method of direct control had no appreciable effect upon the numbers of clerids, which, owing to their great mobility, could

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escape the high temperatures fatal to the barkbeetle broods. Person suggests that while the clerid cannot be expected to solve the control problem, its effectiveness can be increased by methods which protect it, even at the expense of a slight lessening of the efficiency of artificial methods. Hetrick [27], discussing the natural enemies of the Southern Pine beetle in Virginia, refers to the activities of the nematodes, concluding that they cannot be reckoned upon as a major factor except in conjunction with other biological agents. Struble [28], dealing with two predators of the mountain Pine beetle, a green trogosiid (*Temnochila virescens*), and a clerid (*Enoclerus sphegeus*) stated that steps had been taken to modify control practices to protect and promote the increase of these species. In this region, where Sugar Pine was the primary species, predators were the most efficient barkbeetle enemies, as they alone could attack the broods under the thick bark. Attempts were made to devise a technique of large-scale production, economically adaptable in times of outbreak, but results were disappointing, the cost of rearing being too high. Without some means of large-scale rearing of the predators, there is small hope of increasing their usefulness apart from natural protection during forest operations. A United States report of 1946 [29], on the Engelmann Spruce beetle in Colorado, stresses the value of woodpeckers as an enemy. The report recommends a long-term study of their habits and fluctuations in number, to determine the part they play in changes in barkbeetle population.

Barkbeetles and Sap-staining Fungi.

Spread of sap-staining fungi in association with barkbeetle attack is a universal phenomenon as shown, for example, by Butovitsch and Spaak's experiments in 1939 in Sweden [31] on windthrown trees. Best control against both insects and fungi was achieved by storing the logs in wet peat-land. Rennerfelt [32], studying the same problem in 1944, obtained results largely in agreement with the above, and concluded that winter-felled, unbarked timber, protected from insects, is less subject to stain than summer-felled timber.

Under North American conditions, the sap-stain problem assumes a graver aspect. Several of the fungi concerned are pathogenic, killing the cambium of living trees as they invade the tissues. Wright [33] found two such fungi associated with *Scolytus* species attacking White Fir (*A. concolor*). There was evidence that the fungi had probably been introduced by the beetles, their association being definitely helpful in the establishment of the broods. Craighead and St. George [34] describe an outbreak of the Southern Pine beetle in Virginia, in which the attacked trees died rapidly owing to penetration by blue stain accompanied by rapid desiccation, which caused complete breakdown of the phloem region. When beetle attack lessened, however, it was found that the amount of stain present was insufficient to cause the death of many trees. This suggested complete correlation between barkbeetle and fungus. Bramble and Holst [35] have also described a complex invasion by a number of fungi accompanying *Dendroctonus* attack. Their interference with conduction and possibly their reducing the humidity of the stem (which would favour the multiplication of beetle broods), hastened the death of the tree.

Direct Control by Chemical Methods.

(a) *Europe:* Wellenstein [36] in East Prussia, and Schwerdtfeger [37] in the Harz region, have experimented with various poisons in spray and dust form, in an attempt to cheapen methods of treating trap logs set for *Ips typographus*. The former appears to have had most success with a dinitro-*o*-cresol dust, but results are inconclusive. Schwerdtfeger's recent experiments have been directed towards finding a spray or dust which will not only kill adults entering the logs, but penetrate the bark and kill *in situ*. He appears to have had little success with the former aim, as the adults, preferring trees with rough bark, enter under the bark scales, and thus the effect of a spray is lessened. As regards the second object, results are more promising, the spray penetrating through entrance holes and ventilation tunnels. So far, however, no experimental details have been published.

In Switzerland, Roth and Zehnder [38, 39] describe results obtained with a proprietary DDT insecticide, 'Gesarol', in dust and spray form, against *Ips typographus* on standing trees and in trap logs. Aerial dusting and motor dusting of trees from the ground have so far proved unpractical and uneconomic, the amount of dust required being too great for forest operations on any scale. Treating the forest floor with Gesarol against hibernating adults likewise proved only partially effective, as

only a certain % hibernated there. Treating trap logs shows promise, and is recommended, but results are still inconclusive.

(b) U.S.A.: The annual budget of the U.S. Bureau of Entomology for barkbeetle investigations and control, is now about \$170,000. This covers surveys of large areas (23,000 acres in 1940), study of the extent and character of outbreaks, directing and supervising control, and making recommendations. Direct control—whether it be the original 'cut, peel, and burn' method; the burning of bark on standing trees, a method applied to Lodgepole Pine; the application of solar heat to kill the broods *in situ*; or the application of chemicals to the bark—is an expensive matter, and can only be carried out in a small % of cases. These include treatment of valuable timber in national parks and game reserves, and valuable stands which are accessible, and whose treatment is accessory to a larger plan of silvicultural control.

Chemical control has been tried during recent years, and a paper by Gibson [40] in 1943 discusses the value of penetrating sprays against the mountain Pine beetle in Lodgepole Pine and Whitebark Pine. The spray used was 1 part of orthodichlorobenzene to 4 of Diesel oil, and it was claimed that it combined cheapness with great penetrating power and high toxicity to the broods. Being fireproof, it could be used at critical periods in late spring and summer, when fire hazard banned ordinary control methods. Cost of material, in the author's opinion, should be offset by lower operational expenses spread over a longer period. Unfortunately, this type of spray, effective in the case of Lodgepole Pine, has not proved so with the thicker-barked Ponderosa and Sugar Pines. Aerial spraying has also been tried in the case of the Engelmann Spruce beetle. The experiment, in which DDT and benzene hexachloride were used, was ineffective in reducing the numbers of attacked trees in the areas treated [29].

Silvicultural Control.

In 1941 Graham [41], discussing some practical aspects of forest entomology, expressed the view that, so far, actual insect control in the forest was, practically speaking, non-existent. While recognizing the help natural agents can give, he considered that these operate chiefly with the introduced species, having little effect upon native species. Classifying the forest types according to their degree of insect hazard, he grouped them as follows:—(1) Coniferous stands—High hazard: dominant pure Spruce with average d.b.h. 12 in.; Spruce and Balsam mixture of merchantable size, and over-mature or open stands of Lodgepole or Jack Pine. Medium and low hazard: pole and sapling stage of the first two, and dense young stands of Lodgepole Pine. (2) Mixed conifer and hardwood stands—low hazard under all conditions.

To effect a radical improvement in the present situation, he recommends the early cutting of susceptible types, and their replacement with less vulnerable ones. He would encourage, for example, admixture of Aspen and Birch with conifers. Cutting areas should be reduced to minimum economic size, say 40 acres, and a ten-year gap should separate cuttings on contiguous areas. The forestry programme should be well planned in advance, and more attention paid to providing a good system of primary and secondary roads. Damage by wind, fire, or insects should be cleared up in the shortest possible time. It would be possible in this way, he thinks, to create insect-proof forests, or to approach that ideal. The initial expense would be heavy, but offset by the benefits gained. Indeed, unless some such plan is put into operation, the next 50 years may well see the insect hazard involve a greater timber stand than logging can utilize.

Sanitation-Salvage Logging.

Keen and Salman [42], surveying progress made in barkbeetle control in 1942, criticized the temporary effect of most methods now in use, and the expense which limited their employment. They pointed out that none of them really get at the root of the problem, which is to devise a control method based on knowledge of the fundamental factors rendering trees prone to barkbeetle attack. Further studies over the past few years on the symptoms shown by barkbeetle-infested trees, have initiated the idea of tree and stand classification on the basis of their liability to attack. Dunning had produced such a classification in 1928, and Keen, in 1936, divided the Ponderosa Pine types into 16 groups or classes, each based upon age and crown vigour. This was followed by Dunn's classification in which he recognized 7 classes of tree in virgin Ponderosa Pine. The characters

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chosen could be easily recognized in the field, and indicated in a general way those trees which represented the highest risk of loss over a long period, but they did not show which tree types were likely to suffer over a short term.

Dunn's work was followed by that of Salman and Bongberg [43] on the Ponderosa and Jeffrey Pine areas of N.E. California. These authors began with the idea of making a 'light sanitation cut' in green stands, removing as many trees as possible that were likely to die in the near future. Their problem lay in choosing criteria by which such trees could be selected, and in applying the method in the field. Four ratings were finally chosen. The characters which determined the degree of hazard in each class were recognizable at sight, 18,056 trees were classified, and over a 3-year period, timber cruises showed that more than 84% of the losses occurred in trees classified as high-risk, actually constituting only 11.5% of the total stand. So far, removal of high-risk trees from green stands has reduced subsequent infestation and loss by 90.6% in the first year, 82% for a further 2 years, and 71.9% for the 3 following years. In 1942, Orr [44] forester to the Weyerhaeuser Timber Co., discussed the technique, now known as 'sanitation-salvage' logging, from the viewpoint of the timber owner. In the first place, it was known that the method could only be used in suitably accessible sites, and that the aim was to remove in advance the majority of trees likely to be killed by beetles over the next 10-year period. The cost of the operation was heavy, running from \$1.50 to 2.25 per 1,000 bd. ft., but this figure was offset by the timber value saved over a 5- to 6-year period. The timber removed, being still green, showed negligible insect and fungus damage. The author considers that the method has considerable promise, but that further experiments will have to be made in the technique of exploitation, and it still has to be shown how long such treatment will continue to be effective. Part of the answer to this last question lies in obtaining more precise details of the particular characteristics of trees which are, respectively, susceptible and non-susceptible. By 1945, the method was in general use in the Ponderosa areas attacked by the western Pine beetle in Oregon and Washington. In a popular article of that year [45] it was pointed out that since the first experiment in 1937, reduction of losses amounted to 70-90%, as compared with losses on untreated areas. The sanitation-salvage cut represented 13-30% of the stand, and costs of working were higher; but a margin of profit remained, which compared well with the cost of direct control at \$3 to 5 per 1,000 bd. ft., and no return from salvage. The limitations of the method were noted, and it was found that, on occasion, it was better to make a utilization cut at once, rather than proceed on sanitation-salvage lines. The article also notes that the method reduces risks from attacks by lesser pests such as *Ips* species, crown defoliators, or other *Dendrocotonus* spp., such as mountain Pine beetle. In the same year, 1945, Keen [46], in a review of progress in control during the second world war, discussed the work that had been done on the hazard rating of Ponderosa Pine. An important paper on barkbeetle hazards in N.E. California [47], had appeared in 1941. A survey of some 2,750,000 acres was made in these regions, based upon site conditions, past beetle losses, and the % of high-risk trees found per unit area. Similar work had also been carried out in Oregon. These surveys were of particular value to timber managers, enabling them to fix a priority value on selective logging plans, and to determine the degree of cut necessary to eliminate losing elements, obtain beetle control, and increase net growth.

Bongberg [48], working in co-operation with the McCloud Lumber Co. in California, in 1937 made a light selection cut of 276 trees, totalling 660,000 bd. ft., on 1,440 acres. Comparing the cost of this cut with the value of trees lost on uncut areas where direct control had to be applied, it was found that the loss reduction on the former amounted to 84.7%. The stumpage value of timber saved, at \$4 per 1,000 bd. ft., realized 2,580 dollars over a 6-year period, and the operation paid for itself.

The latest account of determinations of barkbeetle hazard in the Pine stands of N.E. California is that of Johnson [49] in 1949. He defines 5 classes of hazard, applying them, in the main, to virgin stands. He states that little has been done, so far, to measure hazard on the cut-over reserves. The classification adopted was that of Salman and Bongberg, 1942, and in sample-plot tests scattered over the whole area, 83% of the total timber loss occurred in trees determined as high-hazard by that classification. Sampling was carried out in strips, and each green Ponderosa or Jeffrey Pine was classified in three ways, viz. according to Bongberg's risk class, Keen's susceptibility class, and Dunning's tree classification of 1928. In each strip, the % of stand represented by fallen or standing,

sound 'snags' (dead trees), and the current % of high-risk trees, were calculated, and the average of these two designated as the index number of the strip. Index numbers 0 to 9 covered the very low and low hazard classes, 10 to 17, moderate hazard, and 18 to 27 plus, the high and very high hazard. Distribution of the 5 hazard classes in the average Pine stand works out roughly, per acre, as follows. In the very low hazard class, the snags and very susceptible green trees amount to 2,000 bd. ft., and the resistant green trees to 16,000 bd. ft. In the low hazard class, the snags are 1,000 bd. ft., the susceptible green trees rise to 2,000 bd. ft., and resistant trees fall to 13,000 bd. ft. In contrast, in the high and very high hazard areas, snags rise to 3,000-4,000, very susceptible green trees to 3,000, and the resistant green trees fall to 8,000-5,000 bd. ft.

The author claims that the following can be calculated from the data obtained: (a) Current volume of high-risk lumber to be cut. (b) Numbers of men, amount and type of equipment required, and net cost plus returns on each operation. (c) Choice of areas, giving priority to those most threatened. Recommendations covering a 15-year period were:—For very-low-hazard areas, no control. For low-hazard areas, one direct 'cut, peel, and burn' operation in the whole period. For moderate-hazard areas, a sanitation-salvage cut averaging 13% of the stand on better sites. On high-hazard areas, a cut averaging 23%, and for very high hazard, up to 85% of the stand, leaving only low-risk trees of small diameter in cut-over reserves.

The main purpose of the classification is to aid in the control of current or imminent barkbeetle attack. It can, however, also be used by foresters to circumvent barkbeetle damage in subsequent stands of mature timber. The planning of future timber crops is concentrated in today's low-hazard areas. In high-hazard areas, more frequent control measures will be necessary, or a shortening of rotation to avoid the accumulation of mature or overmature trees, which are most frequently attacked by the beetles.

There is no doubt that this new silvicultural approach to the barkbeetle problem has put the whole question of control on a much more satisfactory basis. It is also obvious that in carrying out these measures, a co-operative spirit is required and is being developed between foresters, forest entomologists, timbers owners, and logging experts. These together must play their part in the fight to save valuable timber from the menace of wholesale destruction.

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ABSTRACT SECTION

NOTE.—With this volume we stop printing the decimal classification numbers against individual abstracts. Full inquiry has shown that the use made of these numbers is incommensurate with the labour and expense involved in printing them.

0. GENERAL FORESTRY

01. TERMINOLOGY. NOMENCLATURE. MATHEMATICAL AND STATISTICAL ANALYSIS

See also *For. Abstr.* 11
(Nos. 306–7, 309, 335, 753).

1. YATES, F. **Recent developments in the design of experiments.** Graduate School, U.S. Dep. Agric. 1947. pp. 9. 33 refs. [Rothamsted Experimental Station, Harpenden, England.]

02. DICTIONARIES

2. Vocabulaire forestier: I, français-anglais; II, anglais-français. [**A forestry vocabulary: I, French-English; II, English-French.**] Association des ingénieurs forestiers de la Province de Québec, Ottawa. 1946. pp. 502. Price \$5.00 (£1 12s. 6d.).

05. PERIODICALS

3. **Revue forestière française.** École nationale des Eaux et Forêts, Nancy. No. 1, 1949. pp. 56. [F.]

It is intended to publish 10 numbers a year. Annual subscription is 500 fr. in France, 600 fr. abroad.

4. **Colony of North Borneo Forest Department Annual Report 1947, [and review of period January 1941 to December, 1946].** Forest Department, Sandakan. 1948. pp. 59 + map.

06. CONFERENCES. EXHIBITIONS

See also *For. Abstr.* 11 (Nos. 36, 304, 649).

5. **Proceedings of the Fifth British Empire Forestry Conference, Great Britain, 1947.** Forestry Commission, London. 1948. pp. 280. Price 10s. net.

Includes reports of discussions, and complete text of resolutions, but not papers read or presented to the conference.

6. PHILIPPIS, A. DE. I problemi della selvicoltura mediterranea discussi da una sotto-commissione della F.A.O. [**Mediterranean forestry problems discussed by a sub-committee of FAO.**] *Ital. for. mont.* 4 (2), 1949 (78–82). [It.]

A short account of the subjects discussed, and list of papers read, at the meeting in Rome in Dec. 1948.

7. GARDNER, R. C. B. **Labelling and arranging forestry exhibits.** *Quart. J. For.* 43 (2), 1949 (71–3 + 5 photos).

07. EDUCATION AND RESEARCH. MUSEUMS. EXPERIMENTAL FORESTS

See also *For. Abstr.* 11 (Nos. 1, 793–4).

8. BIRCH, T. T. C. **Forestry research and education in New Zealand.** *Unasylva* 3 (2), 1949 (73–9).

9. BONNER, E. **The silvicultural research programme of the Spruce Falls Power and Paper Company Limited.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1006 (F–2), 1949. pp. 4.

10. KOTOK, E. I. **Organization of research in the U.S. Forest Service.** *Unasylva* 2 (2), 1948 (69–76).

11. HYDE, H. A. **The forestry collections in the Department of Botany, National Museum of Wales.** *Quart. J. For.* 43 (2), 1949 (80–2).

12. JONES, G. N., and MEADOWS, E. **Principal institutional herbaria of the United States.** *Amer. Midl. Nat.* 40 (3), 1948 (724–40).

Three lists, arranged (1) according to age, (2) according to number of specimens, and (3) in alphabetical order, with location, name of director, and date of foundation.

13. MARPLES, G. **Planning for posterity.** *B.C. Lumberm.* 33 (3), 1949 (62-3, 116, 118).

The Powell River Co.'s experimental forest in British Columbia has been established primarily for investigating problems of thinning, selective cutting and reforestation in immature second-growth stands. The main forest type is composed of 50-year-old Douglas Fir, which originated after logging in the 1890's. Work on the project began in 1948 and follows 5 main courses:—(1) silviculture, i.e. stand treatment, (2) felling and transport, (3) propaganda, (4) production of firewood for local needs, (5) landscape improvement. Sample plots have already been established for silvicultural studies and 3 different methods of thinning have been tried. Natural regeneration studies and the preparation of volume tables are also under way.

14. FOSTER, C. H., and KIRKLAND, B. P. **The Charles Lathrop Pack demonstration forest. Results of twenty years of intensive forest management.** Charles Lathrop Pack Forestry Foundation, Washington, D.C. 1949. pp. 36.

09.1. Forest History

See also *For. Abstr.* 11 (No. 792).

15. HANSEN, E. Supplement til 'Historiske Optegnelser om Trævæksten paa Bornholm'. [Supplement to 'Historical notes on the trees of Bornholm'.] *Dansk Skovforen. Tidsskr.* 34 (1), 1949 (6-26). [Dan.]

09.2. Pre-history. Pollen Analyses, etc.

See also *For. Abstr.* 11 (Nos. 151-3, 196).

16. SIMPSON, J. B. **Fossil pollen of *Metasequoia* type.** *Nature, Lond.* 163 (4150), 1949 (771-2).

Fossil pollen grains found in Tertiary coal from Mull show a striking resemblance to the pollen of *M. glyptostroboideus*.

17. LONA, F., and TORRIANI, A. Osservazioni sulla diffusione postglaciale dell'abete nel versante meridionale delle alpi. [The post-glacial diffusion of *Abies alba* on the southern slopes of the Alps.] *Nuovo G. bot. ital. (n.s.)* 51 (1/4), 1944 (70-86). 5 refs. [It.it.] O.B.D.

18. BANTI, G. Avanzi di abete bianco sull'Appennino piemontese. [Remains of *Abies alba* in the Piedmontese Apennines.] *Nuovo G. bot. ital. (n.s.)* 54 (3/4), 1947 (713-23). 7 refs. [It.it.f.] O.B.D.

Fossil remains of *Abies alba* discovered in a valley where this species no longer survives, led to an investigation of physical and biotic conditions and it is concluded that human intervention alone could not account for its disappearance in favour of Beech.

19. TONGIORGI, E. Grano, miglio e fave in un focolare rituale dell'età del bronzo a Grotto Misa (bassa valle della Fiora). [Wheat, millet and beans in a Bronze Age ritual hearth at Grotto Misa (Lower Fiora valley).] *Nuovo G. bot. ital. (n.s.)* 54 (3/4), 1947 (804-6). [It.] O.B.D.

Charcoals found at all levels of the site included *Quercus ilex*, *Rhamnus alaternus*, *Ulmus campestris*, *Fagus sylvatica*, *Carpinus betulus*, *Ostrya carpinifolia*, *Corylus avellana*, *Populus* or *Salix* sp., *Acer* sp., and *Cornus mas*. Only the first two of these species are now found at this altitude (120 m. above sea level), all the rest, and especially the Beech, forming a complex which at the present time is found only at a considerably greater elevation.

09.4. Forest Statistics

See also *For. Abstr.* 11 (Nos. 29, 31, 542, 583, 601-12).

20. QUATTROCCHI, G. Selvicoltura e statistica. [Forestry and statistics.] *Ital. for. mont.* 4 (2), 1949 (83-93). [It.]

The author analyses the data given in a recent bulletin for production of wood in Italy on non-forest land, distinguishing conifers and broad-leaved species; firewood, cordwood, and charcoal; and arable, pasture and waste land.

21. Domänverket år 1947 av Kungl. Domänstyrelsen. [Work in the State Forests, 1947, by the Royal State Forestry Board.] *Sveriges Officiella Statistik. Kungl. Boktryckeriet. P. A. Norstedt & Söner, Stockholm.* 1949. pp. 118. [Sw.]

22. HAGBERG, E. Riksskogstaxeringen av Kopparbergs län, åren 1943 och 1944. [The State Forest Survey of the county of Kopparberg, 1943-4.] *Medd. Skogsforsk. Inst., Stockh.* 37 (9), 1948. pp. 108. [Sw.sw.e.]

23. HOLCK, C. E. En arealstatistik for skovene 1945. [Area statistics for [Danish] forests, 1945.] *Dansk Skovforen. Tidsskr.* 34 (4), 1948 (141-54). [Dan.]

24. Oversigt over de Danske Statsskoves Udbytte af Ved og Penge for Finansaaaret 1947-48. [Review of the timber and financial yields of the Danish State Forests for the financial year 1947-8.] Nielsen & Lydiche (M. Simmelkiær), Copenhagen, 1949. pp. 16. [Dan.]

25. Économie de la production forestière en Belgique. [Forest products in Belgium.] *Bull. Soc. for. Belg.* 56 (5), 1949 (195-216). [F.]

Statistics of current production, consumption, imports etc.

26. Statistisches Jahrbuch der Schweiz, 1946. [Statistical yearbook for Switzerland, 1946.] Eidgenössisches Statistisches Amt, Bern [1948?] pp. x + 623. [G.F.]

27. [Swiss forest statistics for 1947.] *Schweiz. Forststatist.* 12 (3), [1948?]. pp. 38. [G.F.]

28. SHANTZ, H. L. An estimate of the shrinkage of Africa's tropical forests. *Unasylva* 2 (2), 1948 (66-7). 3 refs.

The present forests of tropical Africa occupy about 531 million ha.; the adjacent savanna and grasslands 991 ha., most of which, under proper management, is capable of producing forest. The general conclusion is that the forests of tropical Africa, which are shrinking rapidly at the present time, have already been reduced to a third of what they probably were originally.

09.7. Monographs of Individual Forest Regions

See also *For. Abstr.* 11 (No. 791).

29. ILVESSALO, Y. The forests of present-day Finland: a description based on the National Forest Surveys. *Commun. Inst. for. Fenn.* 35 (6), 1949. pp. 56. 11 refs. [E.] Cf. *For. Abstr.* 10 (No. 1550).

30. ROLLEY, J. Forest conditions in Syria and Lebanon. *Unasylva* 2 (2), 1948 (77-80).

31. Forest problems of Africa. *Unasylva* 3 (2), 1949 (63-72).

32. TOTHILL, J. D. [Editor]. Agriculture in the Sudan, being a handbook of agriculture as practised in the Anglo-Egyptian Sudan, by numerous authors. Oxford University Press, London, 1948. pp. xviii + 974 + 1 dgm., 2 tbls., 6 maps and numerous photos. Price £2.2s. O.R.E.

Section III consists of monographs by different authors on the individual provinces of the Sudan, including brief notes on the forests. [Cf. *For. Abstr.* 11 (Nos. 133, 596).]

33. GIORDANO, G. Forêts et bois de l'Éthiopie. [Forests and timbers of Abyssinia.] *Bois For. Trop.* Nos. 5; 6, 1948 (11-5; 11-4). [F.]

34. MARCH, E. W. Pine forests of the Bahamas. *Emp. For. Rev.* 28 (1), 1949 (33-7 + 6 photos).

The Pine [*Pinus caribaea*] forests of the Bahamas represent a pioneer stage on pure oolitic limestone with almost no soil covering. Very few trees grow to more than 12 in. in diameter, and that over a period of 100 years. They are, however, remarkably straight and free from branches, and have a remarkable power of regeneration in the most adverse circumstances. Any exploitation or damage by hurricane or fire is followed by profuse natural regeneration.

Past workings have been on a systematic basis and good records kept in spite of almost complete absence of any official control except a minimum-diameter felling limit of 6 in. Working started in 1900, and the writer estimates that the first cut will be completed by 1978, compared with a prescribed economic rotation of 75 years. A short account is given of the difficulties of extraction, particularly the long barge haul and loading into ships on the open sea.

35. BEVAN, A. Forest resources of tropical America [a review]. Pp. 179-91 (+ 3 photos) in *New crops for the New World*. The Macmillan Co., New York. 1945. L.S.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1. *Atmosphere, Meteorology*

See *For. Abstr.* 11 (Nos. 626-31).

11.2. *Climate and Microclimate*

See *For. Abstr.* 11 (No. 134).

11.4. *Soil*

36. Comptes rendus de la Conférence africaine des sols Goma (Kivu) Congo Belge 8-16 Novembre 1948. I. [Proceedings of the African Soil Conference held at Goma (Kivu), Belgian Congo, 8-16 Nov. 1948. I.] *Bull. agric. Congo belge* 40 (1), 1949. pp. 1048. [F.]

The first of 3 numbers to be devoted to the proceedings of the conference.

37. JACQUES-FELIX, H., and BÉTRÉMIEUX, R. Étude de quelques sols tropicaux. 1. Comparaison d'un sol forestier et d'un sol de savane voisin de même origine. 2. Étude d'un sol forestier du Sud-Cameroun. 3. Étude d'un sol écobué des hauts plateaux du Fouta-Djallon. [Study of some tropical soils. 1. Comparison of adjacent forest and savanna soils of similar origin. 2. Study of a forest soil of South Cameroun. 3. Study of a burnt soil in the high plateaux of Fouta-Djallon.] *Bull. agric. Congo belge* 40 (1), 1949 (171-92). 15 refs. [F.]

11.42. *Soil Chemistry*

38. TARRANT, R. F. The rôle of organic matter as a source of nitrogen in Douglas-Fir forest soils. *Res. Notes Pacif. Northwest. For. Range Exp. Sta.* No. 48, 1948. pp. 5. 5 refs.

(1) A study has been made of the relation between organic matter and soil nitrogen in five areas of the Douglas-Fir region in Oregon and Washington. The direct correlation between organic matter and soil nitrogen is shown for this region. (2) Results of the study emphasize the fact that most of the nitrogen/organic-matter content is in the uppermost portion of the forest soil. (3) A rapid means of determining total soil nitrogen in Douglas-Fir-region soils is shown. When the percentage of organic matter of mineral horizons of Douglas-Fir-region soils is multiplied by the

conversion factor 0.027, an approximate measure of the total soil nitrogen is obtained. *Author's summary.*

11.43. *Biology of Soil, including Mycorrhiza*

See also *For. Abstr.* 11 (Nos. 654-5).

39. LAUDELLOT, H., and GILBERT, G. Quelques caractéristiques microbiologiques de profils de forêts de la Cuvette centrale. [Some microbiological characteristics of forest soil profiles from the central [Congo] basin.] *Bull. agric. Congo belge* 40 (1), 1949 (451-82). 25 refs. [F.]

The profiles examined for this study were in:—(1) *Macarobium deweyrei* forest; (2) mixed plateau forest; (3) forest dominated by *Cynometra alexandri*; (4) forest on old islands in the river Congo; (5) *Musanga smithii* forest; (6) plantations. Analyses are set out in full. The most striking general characteristics of these soils were the relatively restricted number of micro-organisms, and, amongst those micro-organisms, the relatively low abundance of fungi; below 5-10 cm. the fungi present in the soil were negligible. There was no confirmation of the current opinion that *Aspergilli* are more abundant than *Penicillia* in tropical forest soils. An unexpected finding was the high proportion of actinomycetes, even in strongly acid soils.

40. LINDEBERG, G., and KORJUS, M. Gallic acid and growth of *Marasmius foetidus*. *Physiol. Plant., Copenhagen* 2 (1), 1949 (103-13). 8 refs. [E.e.]

Further researches on the metabolism of litter-decomposing hymenomycetes. [Cf. *For. Abstr.* 9 (Nos. 54-5, 2046); 10 (No. 2424).]

41. FORSSLUND, K.-H. Något om insamlingsmetodiken vid markfaunaundersökningar. [Notes on collecting technique for research on soil fauna.] *Medd. SkogsforsknInst., Stockholm* 37 (7), 1948. pp. 22. 13 refs. [Sw.sw.g.]

11.47. *Maintenance of Favourable Soil Conditions*

See also *For. Abstr.* 11 (No. 411).

42. RAWITSCHER, F. Die Erschöpfung tropischer Böden infolge der Entwaldung.

[The exhaustion of tropical soils following deforestation.] *Acta tropica*, Basel 3, 1946 (211-41). 31 refs. [G.f.e.] [Departamento de Botanica da Faculdade de Philosophia, Sciencias e Letras da Universidade de São Paulo, Brasil.] O.R.S.

Discusses the remarkably rapid loss of fertility in soils of deforested humid tropical regions, with illustrations from Brazil. The severe leaching which causes this soil degradation is due to (1) the small adsorptive power of tropical clays and (2) the great depth of the soil, which, in humid tropical areas, may amount to 10-15 m. Soil erosion is often not involved in this type of soil deterioration. The author describes how forest vegetation keeps this leaching process under control, and maintains the soil fertility. Because of the depth of the soil, rain water percolates to great depths and forms underground reserves, which are available to deep-rooted species. [Cf. *For. Abstr.* 6 (12).] The tree roots intercept and take up the water with its content of mineral salts, which eventually become part of the tree and return to the upper soil layers with the fallen leaves. The tree roots also penetrate to the area of the decomposing rock, where they take up fresh mineral salts, which become part of the topsoil in the same way. It is therefore useless and dangerous to apply the agricultural methods of a temperate climate to such soils. Shallow-rooted crops must be avoided, and tree-like, deep-rooted plants favoured.

11.49. Soil Types

See also *For. Abstr.* 11 (Nos. 136-7, 783)

43. MUCKENHIRN, R. J., WHITESIDE, E. P., TEMPLIN, E. H., CHANDLER, R. F. JR., and ALEXANDER, L. T. **Soil classification and the genetic factors of soil formation.** *Soil Sci.* 67 (2), 1949 (93-105). 33 refs.

44. GARDNER, R. A., and RETZER, J. L. **Interpretive soil classification: timber, range and watersheds.** *Soil Sci.* 67 (2), 1949 (151-7). 15 refs.

11.6. Hydrographical Conditions. Water and Soil Conservation

See also *For. Abstr.* 11
(Nos. 134, 288, 294-7).

45. KIRWALD, E. **Grundzüge der forstlichen Wasserhaushaltstechnik (einschliesslich**

Wildbachverbauung). [Outlines of forest hydrology and water management (including torrent training).] J. Neumann, Neudamm, 1944. pp. 362 + map. 314 refs. [G.] Price £1 6s. 0d.

A manual, on conventional lines, dealing first with the fundamentals of the water cycle and their relation to forests, both generally and in Germany; and secondly with the measurement and regulation of the water cycle in its various phases, with particular attention to torrent control. The long bibliography is drawn almost entirely from Central European sources.

46. **Biology and civil engineering. Proceedings of the conference held at the Institution September, 1948.** Institution of Civil Engineers, London. 1949. pp. 258 + 70 photos.

Includes the following papers: Soil erosion and soil conservation in New Zealand (W. L. Newnham); Biology and its relation to soil erosion and soil conservation (A. J. Healy); Soil erosion and some problems connected with its control (J. A. Vorster); The influence of vegetation on floods (F. C. Ford Robertson); The principles governing transpiration by vegetation (R. K. Schofield and M. L. Penman); The effect of vegetation on the stabilization of artificial slopes (A. H. Toms); The use of vegetation in stabilizing artificial slopes (B. J. J. Moran); The stabilization of sand-dunes by vegetation (V. J. Chapman); The use of vegetation to stabilize sand-dunes (J. H. van der Burgt and L. van Bendegom); The effect of vegetation on the settlement of structures (W. H. Ward); and The effect of vegetation on the settlement of roads (D. Cronney and W. A. Lewis).

47. DEBENHAM, F. **Report on the water resources of the Bechuanaland Protectorate, Northern Rhodesia, the Nyasaland Protectorate, Tanganyika Territory, Kenya and the Uganda Protectorate.** *Colonial Research Publication* No. 2, 1948. pp. 84 + 11 maps + 24 photos. H.M. Stationery Office, London. Price 10s. 6d.

48. [Snow storage increased by thinning and by harvest cuttings.] *Rep. Rocky Mt. For. Range Exp. Sta.* 1948, 1949 (23-4).

Thinning of dense young Lodgepole Pine stands to an average spacing of 8½ ft. increased snow storage by 23.5%. Making openings 16 ft.

in diameter round crop trees spaced 21 ft. apart, increased snow storage by 16.8%. Harvest cuttings in the Spruce/Fir type, in each case removing 60% of the merchantable volume, increased snow storage as follows:—alternate clear-cut strips 66 ft. wide, 22.4%; removing all merchantable trees in 66-ft.-diam. circles over half the area, 28.7%; cutting all mature and overmature trees, 24%.

49. WILM, H. G., and DUNFORD, E. G. **Effect of timber cutting on water available for stream flow from a Lodgepole Pine forest.** *Tech. Bull. U.S. Dep. Agric.* No. 968, 1948. pp. 43. 56 refs.

For previous interim reports on this experiment at Fraser, Colorado, see *For. Abstr.* 5 (32), 6 (7), 9 (Nos. 80, 1443-4). The present report sums up the results to date. It is concluded that timber cutting in the Lodgepole Pine type of the central Rocky Mountains, where 85-90% of the water yield comes from snow, exerts a real and immediate influence on the amount of water available for stream flow. Thus the heaviest cutting increased the water release by 31% as compared with uncut plots, without visible erosion. The duration of the influence and its quantitative effect on water yield are as yet undetermined.

50. **Partial timber cutting did not change quality of water.** *Rep. Rocky Mt. For. Range Exp. Sta.* 1948, 1949 (3-4).

This experiment in the headwaters of the Eagle River was established in 1947 to determine the effect of commercial timber cutting on the amount, distribution, and quality of stream flow. Continuous stream-flow records were taken on three forested catchments from the middle of April to the middle of October, 1948. Results obtained in this first season corroborate those of previous studies, which indicated that erosion subsequent to logging is almost entirely absent in the high-altitude country of the Rocky Mountains area.

51. ANDERSON, H. W., and TROBITZ, H. K. **Influence of some watershed variables on a major flood.** *J. For.* 47 (5), 1949 (347-56). 13 refs.

A major flood-producing storm in southern California was studied. The individual effects of some storm and watershed variables on the momentary peak discharges measured at gaging stations and deposition of sediment in reservoirs,

were obtained by multiple regression analysis. Equations are given expressing the relations found. The amount of sedimentation of reservoirs as the result of the storm was found to be quantitatively related to the maximum 24-hour precipitation, the forest cover density, the barren area, the area of old fires, and the area of the individual watershed. The peak discharges from watersheds were found to be related to the forest cover density, the maximum 24-hour precipitation, the watershed physiography, and the area of the watershed. The independent effects of forest fires on peak discharges and deposition from watersheds were isolated and quantitatively estimated. It is concluded that for the area studied, with deeply fractured, permeable rock structures, a decrease in forest cover has an important effect in increasing peak discharges and deposition during major floods. *Authors' summary.*

52. EDWARDS, D. C. **Conservation of vegetation in East Africa.** *Bull. agric. Congo belge* 40 (1), 1949 (689-702). 6 refs. [E.]

53. WICHT, C. L. **The rôle of South African forestry in the conservation of natural resources.** *Bull. agric. Congo belge* 40 (1), 1949 (657-70). [E.]

54. TEMPANY, H. A. **The practice of soil conservation in the British Colonial Empire.** *Tech. Commun. Bur. Soil Sci., Harpenden* No. 45, 1949. pp. vii + 106. 31 refs.

Includes short sections on windbreaks, control of shifting sand, and the rôle of afforestation and forestry generally in conserving the soil. A final chapter summarizes the legislation in force in various colonial dependencies. [Cf. *For. Abstr.* 7 (No. 1073).]

55. BOYKO, H. **Science and erosion problems in the Middle East.** *Repr. from Journal of the Middle East Society* 1 (3/4), 1947. pp. 22. 23 refs.

The author sets out to show the possibilities of gauging the magnitude of soil erosion in the Middle East by non-experimental methods such as the use, as indicators, of old trees, fossil sand dunes or ancient heaps of debris, lichen growth, root systems, archaeological remains, and geological stratification. He stresses the importance of discovering the 'compensation angle of erosion', namely that angle (to be determined for each slope) at which the

destructive forces of erosion are balanced by soil formation. A local example is quoted.

In connexion with the use of old trees as indicators of erosion, the author makes a digression on the age to which various species live:—*Cedrus libani* up to 4,000, Olives up to 3,000, *Zizyphus spina-christi* 1,500, *Haloxylon persicum* 1,500, *Pistacia atlantica* 1,000, Laurel and Carob tree 500 years. The Olive is the most suitable species for measuring erosion, owing to the spreading base or root plate, which may be completely uncovered by erosion, or alternatively covered by soil accumulation. The author examined more than 1,000 Olive trees in Palestine and found that, on slopes, the ratio of trees with uncovered to those with covered root plates was 90 : 10, whereas on the plains it was 15 : 85. A tree of 30–35 cm. d.b.h. may be 80–100 years old (the actual age may often be established from historical records), so that if the root plate is, say, 25 cm. above the soil, it is clear that 250 mm. of soil must have been removed in the course of the past 100 years, an annual average erosion rate of $2\frac{1}{2}$ mm. The maximum rate, determined in this way, for the hill country of Palestine is $4\frac{1}{2}$ mm. per annum.

Finally a note is given on the high potential rate of soil formation in the Middle East, due to climatic factors.

56. LI, L. Y., and CHOU, C. Y. A preliminary survey of wind erosion with recommendations for soil protection on Haitan Island, Fukien. *Fukien agric. J.* 10 (1/2), 1948 (37–48). 22 refs. [Chin.e.]

57. DUBOIS, J. Note sur l'ensablement des 'niayes' de M'Boro et recherches d'un moyen efficace de lutte. [The encroachment of sand on the 'niayes' of M'Boro, and researches into an effective means of control.] *Bull. agric. Congo belge* 40 (1), 1949 (808–14). [F.]

'Niayes' are moist, sometimes flooded, depressions between the coastal dunes in Senegal, which are gradually being buried in sand. The remedies proposed are (1) to forbid cultivation or pasturing in the more dangerous areas; (2) fixation of the dunes and re-vegetation of the 'niayes' by planting suitable species; (3) construction of windbreaks. The importance of planting contourwise, and with different species suited to different elevations on the dunes, is stressed.

58. BENNETT, H. D. Road construction in forest management. *Sth. Lumberm.* 177 (2225), 1948 (135–7).

Erosion of permanent export roads in the S. Carolina forests, during the period between cuts, is controlled by sowing the road bed and cut banks with *Lespedeza sericea*. Before sowing the soil is analysed, any necessary fertilizer added, and the surface loosened by bulldozer or roadscraper. Both fertilizer and seed are scattered by means of a cyclone seeder. The recommended sowing is 30 lb. of seed per acre. [Cf. *For. Abstr.* 10 (No. 2433).]

59. GJERTSON, J. O. Practical guides for seeding grass on skid roads, trails, and landings, following logging on east-side forests of Washington and Oregon. *Res. Notes Pacif. Northwest. For. Range Exp. Sta.* No. 49, 1949. pp. 5.

60. GLEASON, C. H., and MACBEAN, D. G. Use of the helicopter for sowing mustard seed in burned areas of Southern California. *J. For.* 47 (3), 1949 (192–5). 5 refs.

Cf. *For. Abstr.* 10 (No. 2432). This paper gives an account of several operations.

12. FOREST BOTANY. TREE SPECIES

12.1. General Botany

12.11. Physiology. Reproduction. Growth

12.11.1. Metabolism. Plant Constituents. Photosynthesis. Translocation. Sap Flow. Transpiration. Growth Substances

See also *For. Abstr.* 11 (Nos. 46, 561–3, 567–9, 582, 584–6, 588, 597–8, 654–5).

61. NYSTERAKIS, F., and BERDUCOU, J. Quantités relatives de chlorophylle contenues dans les divers tissus d'*Euonymus japonicus* et d'*Aucuba japonica*. [Relative quantities of chlorophyll contained in various tissues of *E. japonicus* and *A. japonica*.] *Bull. Soc. bot. France* 95 (5/6), 1948 (216–8). [F.] O.B.D.

62. PLOUVIER, V. Sur la recherche du québrachitol et de l'allantoïne chez les érables et le platane. [Research on the presence of

quebrachitol and allantoin in the Maples and Plane.] *C.R. Acad. Sci., Paris* 227 (3), 1948 (225-7). 2 refs. [F.] D.S.I.R.

63. BRUCKNER, V., KOVÁCS, J., and KOCKA, I. Occurrence of betulinic acid in the bark of the Plane tree. *Journal of the chemical Society, London* July, 1948 (948-51). 8 refs. O.R.S.

The substance isolated from the shed bark of *Platanus acerifolia* by sublimation or extraction is identical with betulinic acid. From authors' summary.

64. HIRST, E. L., JONES, J. K. N., and ROUDIER, A.-J. Structure of acorn starch. *Journal of the chemical Society, London* Nov., 1948 (1779-83). 12 refs. O.R.S.

65. DUSSY, J., and SANNIÉ, C. Sur un rhamnoside nouveau extrait des feuilles d'*Erythrophleum guineense*. [A new rhamnoside extracted from the leaves of *Erythrophleum guineense*.] *C.R. Acad. Sci., Paris* 225 (16), 1947 (693-5). [F.] D.S.I.R.

66. PLOUVIER, V. Sur l'étude biochimique comparée de quelques Oleaceae. [On the comparative biochemical study of [bark and leaves of] some Oleaceae.] *C.R. Acad. Sci., Paris* 227 (12), 1948 (604-6). 1 ref. [F.] D.S.I.R.

Including *Fraxinus excelsior* var. *pendula*, *Syringa* spp., *Ligustrum* spp., *Phillyrea* spp., *Osmanthus* spp., *Forestiera* spp., and *Chionanthus* spp.

67. BISWAS, H. G. A note on the saponin from *Sapindus laurifolius*, Vahl. *Journal of the Indian chemical Society, Calcutta* 25 (3), 1948 (151-2). O.R.S.

68. BLUM, G. Ueber osmotische Untersuchungen in der Mangrove. [Studies of osmosis in Mangroves [*Avicennia officinalis*, *Sonneratia* spp., *Rhizophora conjugata*, *Bruguiera* spp. and *Acanthus ilicifolius*.] *Berichte der schweizerischen botanischen Gesellschaft, Zürich* 51, 1941 (401-22). 9 refs. [G.] L.D.U.

69. DANIEL, T. W., Coniferous root exudate. *Plant Physiol.* 24 (2), 1949 (327-30). [Utah State Agricultural College, Logan.] O.R.E.

The volume of root exudate from conifers of various species, was measured at varying

intervals over a period of 13 days. The trees, about 8 months old, were grown in culture solution with aeration and cut at the collar. Exudate from sunflower under similar conditions was measured for comparison. The results are tabulated.

70. MARVIN, J. W. Changes in bark thickness during sap flow in Sugar Maples. *Science* 109 (2827), 1949 (231-2). 7 refs. [University of Vermont and State Agricultural College, Burlington.] O.R.S.

In experiments to study the activity of tissues in the sap-flow mechanism of *Acer saccharum* it has been found that although flow occurs in excised Red Maple stems when supplied with water and allowed to freeze and thaw, none takes place when the tissues exterior to the xylem are removed. Field studies were therefore made in order to investigate physical changes in the bark. Air temperatures were recorded and changes in the bark thickness measured during and between periods of flow. Records during 2 freezing periods and a 4-day period of high temperature in between, show a decrease in bark thickness during cooling and freezing, and a rapid increase on the change to warmer temperatures. Measurements of the diameter of the xylem cylinder show that it changed at the same time and in the same direction as the bark, but the magnitude of the change was quite different.

71. BREMER, H. Beobachtungen an Holzpflanzen im Steppenklima von Ankara. [Observations on trees in the steppe climate of Ankara.] *Revue de la Faculté des Sciences de l'Université d'Istanbul, Série B* 12 (1), 1947 (9-34 + 4 photos). 28 refs. [G.turk.g.] 9 tpls. L.B.M.N.

Forest and orchard trees are discussed. The former are mainly ring-porous; in summer their stomata are open only in the early morning, and transpiration is confined to a very limited period. In the irrigated areas, species are diffuse-porous; because of better water supply, their stomata remain open longer than in the previous group. Young trees close their stomata earlier than the older ones in summer. Chlorosis occurs typically among trees in the steppe area, affecting species not adapted to steppe conditions and in particular diffuse-porous species. Shaded and well watered valleys have a predominantly diffuse-porous

mesophytic vegetation; neither drought nor chlorosis occurs.

72. PIJL, L. VAN DER. Waarom regenboom? [Why 'Rain-tree'?] *Chron. Nat.* 105 (1), 1949 (27-8). [Du.] E.M.B.

The author has observed that some trees of *Pithecellobium* (*Samanea*) *saman*, during the flushing period, 'rain' nectar from the extrafloral nectaries on the leaves. The secretion may be copious, e.g. a glass plate of 17 sq. dm. area, placed under a tree for 1 hour, collected 510 droplets of nectar, which quickly dried with very little loss of volume to a clear, viscous mass. Fehling's solution gave no clear reaction with the fresh material, but a strong reaction after boiling with HCl, suggesting that the droplets contain organic compounds based on hexoses.

73. MESSERI, A. Gli organizzatori del fello-geno e del sughero in giovani rami di *Pinus pinea*. [The growth organizers of phellogen and sugar in young branches of *Pinus pinea*.] *Nuovo G. bot. ital.* (n.s.) 52 (1/4), 1945 (73-9 + 6 photos). 2 refs. [It. it.] O.B.D.

The formation of sugar in *Pinus pinea* depends on two different growth organizers which are responsible respectively for the process of multiplication and that of differentiation. The resin-bearing bundles beneath the epidermis are the organizers of phellogen and the epidermis the organizer of sugar. *From author's summary.*

74. PEARSE, H. L. Growth substances and their practical importance in horticulture. *Tech. Commun. Bur. Hort. Plantat. Crops, E. Mallang* No. 20, 1948. pp. 233. 53 pages of refs. Price 12s. 6d.

75. LINSE, H. Über den Einfluss von Pflanzenextrakten auf das Streckungswachstum, Wurzel- und Sprossbildung bei Pflanzen. [The influence of plant extracts on growth, and on root- and shoot-formation in plants.] *Öst. bot. Z.* 95 (1), 1948 (95-101). 4 refs. [G.g.] A.P.B.

An account of experiments to investigate the properties of dry residues of alcoholic extracts of different plants (including some woody species), alone or in combination with the K salt of β -indolylacetic acid, on cell elongation

(*Avena* coleoptiles) and root and shoot initiation. Results of the *Avena* test varied according to the origin of the extracts some being ineffective, others promoting or inhibiting cell elongation. As regards root and shoot initiation in root sections (*Cochlearia armoracia*), extracts of both growth-promoting and growth-inhibiting types (as judged by the *Avena* test), reduced the effects of the heteroauxin. Thus both types could reduce or completely suppress the capacity of heteroauxin (*a*) to induce root formation and (*b*) to inhibit shoot formation. For case (*a*) it is noted that the extracts inhibiting cell elongation exercised even stronger inhibition of root initiation. In case (*b*) both types of extract could also promote shoot formation in root sections untreated with heteroauxin. These facts are held to suggest that substances of both growth-promoting and growth-inhibiting types may be present in a given extract in proportions that would explain these effects.

76. BULARD, C. Inversion du géotropisme par l'hétéroauxine chez *Thuja orientalis*. [Inversion of geotropism caused by heteroauxin in *Thuja orientalis*.] *C.R. Acad. Sci., Paris* 227 (7), 1948 (443-4). [F.] D.S.I.R.

Treatment of seeds with concentrations of 100-400 mg./l. β -indolylacetic acid brought about a very high proportion of inversion of geotropism, particularly in seedlings kept in darkness.

77. HEMBERG, T. Growth-inhibiting substances in terminal buds of *Fraxinus*. *Physiol. Plant., Copenhagen* 2 (1), 1949 (37-44). 12 refs. [E.e.]

As a result of experiments described in this paper, it appears that dormant terminal buds of *Fraxinus excelsior* contain great quantities of a growth-inhibiting substance, which has largely disappeared by early spring. Treatment of dormant twigs with ethylenechlorhydrin, which is known to break dormancy, also led to its disappearance.

78. EVENARI, M. Germination inhibitors. *Bot. Rev.* 15 (3), 1949 (153-94). 180 refs.

A study of the nature and action of the germination-inhibiting substances found in plants.

12.11.2. *Reproduction. Propagation.**Growth. Development*See also *For. Abstr.* 11

(Nos. 73-8, 101-2, 200-5, 262).

79. POEL, L. W. **Germination and development of Heather and the hydrogen ion concentration of the medium.** *Nature, Lond.* 163 (4147), 1949 (647-8). 3 refs.

Laboratory experiments confirmed the field evidence that the optimum soil reaction for *Calluna* is about pH4. Above this level, germination and growth of seedlings decline and chlorosis increases.

80. **Vegetative propagation (*P. radiata*).** *Rep. For. Timb. Bur. Aust.* 1947, 1948 (13).

Following the results of the previous year, which indicated that cuttings of *Pinus radiata* set in galvanized tubes gave better results than those in nursery beds [cf. *For. Abstr.* 10 (No. 1607)], further work aimed at developing the technique gave the following results:—Tubes $8 \times 1\frac{3}{4}$ in. are a satisfactory size. Nursery compost, decayed needle litter and stable manure used in the proportion of 3 of each to one of sand, make excellent filling for tubes. Cuttings 5 in. long, set 3 in. deep in the tubes, gave the best results. Setting the tubes on the surface or 1-2 in. in the soil gave better results than deeper setting. Removal of the buds and male cones was associated with an increase in strike, and soaking the cuttings for $16\frac{1}{2}$ hours in chloroxone gave an increase in the % of cuttings rooted.

81. SOEPARMA SATIADIREJA, R. **Propagation by cuttings of some tropical plants.** *Chron. Nat.* 105 (1), 1949 (15-9). [E.] [Treub Laboratory, Royal Botanic Gardens, Buitenzorg.] E.M.B.

Gives results of experiments involving 3 types of cutting, 3 different rooting media, and with or without treatment with growth substances (β -indole-acetic and α -naphthalene-acetic acids) in solution or in talc, on the following species:—*Bougainvillea* sp., *Brunfelsia uniflora*, *Capparis heyneana*, *Citrus* spp., *Chodanthus splendens*, *Clerodendron intermedium*, *Combretum grandiflorum*, *Congea velutina*, *Gardenia jasminoides*, *Hibiscus* spp., *Ixora* spp., *Jasminum grandiflorum*, *Licania rigida*, *Mussaenda* spp., *Passiflora vitifolia*, *Petraea volubilis*, *Podocarpus macrophyllum*, *P.*

nagi, *Rondeletia odorata*, and *Sauropus androgynus*. Of the 27 species concerned, 11 failed to root unless treated with a growth substance. Four species (not listed above) failed to root at all. Treatment with growth substances promoted rooting in 20 cases, decreased it in 1 case and had no effect in 6 cases.

82. **Vegetative reproduction of *Leptospermum citratum*.** *Rep. For. Timb. Bur. Aust.* 1947, 1948 (14).

Requisites for obtaining a high % of strike are shading of the cuttings, maintenance of cool, moist atmosphere, and heating of the soil.

83. SHUMILINA, Z. K. Razmnozhenie topolely cherenkami. [Propagation of Poplars by cuttings.] *Agrobiologiya* 1949 (1), (125-30). 5 refs. [Russ.] [Vsesoyuznyĭ n.-i. Institut agrolesomeliatsii, Moskva.] H.S.B.

Experiments were made in 1947-8 with lignified cuttings of 'Red-nerved' Poplar [*P. vernirubens*?] to devise a method to give better root systems, reduce terminal and basal die-back and increase the number of cuttings obtainable per stool shoot. Short cuttings ca. 1-10 cm. long, with 1-3 buds and planted horizontally 3-5 cm. deep, were compared with cuttings ca. 17-35 cm. long, planted vertically. In both cases two methods of making cuttings were tried—(1) cutting flush with the topmost and basal buds, and (2) cutting at the middle of the internodes.

Very short cuttings with only 1 bud were a failure in the nursery, though they sprouted under laboratory conditions. The horizontally planted cuttings 5-10 cm. long were successful, whether planted 3 or 5 cm. deep, except where spoilt by severe wireworm attack. Studies of the root and shoot development of the plants raised showed that this type of cutting was superior to the long type planted vertically. By the autumn, cuttings 7.5 and 10 cm. long had shoots respectively 61 and 75 cm. tall, whereas the vertically planted cuttings, 26 and 31 cm. long, had shoots of only 56 and 37 cm. in height. The stronger shoots were associated with stronger and more finely branched root systems.

On vertically planted cuttings cut flush with the buds, the bulk of the roots developed at the base of the lowest bud and occlusion of the apical cut was good. Those cut at mid-internodes rooted more feebly along the whole

length under ground, the top and bottom portions dying back to the nearest buds.

The horizontally planted short cuttings cut flush with the buds, rooted most strongly at their morphological base, the topmost bud developing into a shoot. Those cut at mid-internodes behaved quite differently. If the shoot grew out from the lowest bud, a strong root system developed at its base and the actual cutting died and was sloughed, leaving a plant externally resembling a seedling. If the shoot grew from the top bud, roots developed at its base and from the sides of the lower bud, always on one side only of the cutting, and vigorous unilateral development of new tissues took place between the two buds, again leading to the sloughing of the dead cutting. In both cases this phenomenon gives rise to healthier plants by reducing the risk of rot. The method needs to be tested in various soils and should be tried with other species.

Normally only well grown 1-year-old wood should be used for cuttings. Experiments with long cuttings of 'Red-nerved' Poplar and the hybrid *P. balsamifera* × *P. berolinensis* showed in both cases that the height of the resulting plants [after 1 growing season?] increased with increasing diameter of the cuttings (the diameter of which ranged from 0.4 to 1.3 cm.). This emphasizes the need for proper care of stool beds. Results for 3-year-old stools of *P. balsamifera* × *P. berolinensis* given different fertilizer treatments, showed that the most heavily fertilized plots produced 1-year-old shoots 161 cm. long and averaged 10 shoots per stool suitable for making cuttings; corresponding figures for the least heavily fertilized plots were 112 cm. and 5 suitable shoots per stool. It is noted in conclusion that with vertically planted cuttings the best results are obtained when they are planted with the topmost bud at the soil surface.

84. GUNCKEL, J. E. **Studies of the development in long shoots and short shoots of *Ginkgo biloba* L. Summaries of theses for the Degree of Doctor of Philosophy, Harvard University, Cambridge, Mass., 1943-5, 1947.** pp. 75-8. L.S.

85. GUNCKEL, J. E., and THIMANN, K. V. **Studies of development in long shoots and short shoots of *Ginkgo biloba* L. III. Auxin production in shoot growth.** *Amer. J. Bot.* 36 (2), 1949 (145-51). 19 refs. [Rutgers

University, New Brunswick, N.J., and Harvard University, Cambridge, Mass.] O.B.D.

Cf. *For. Abstr.* 8 (No. 1643).

86. GUNCKEL, J. E., THIMANN, K. V., and WETMORE, R. H. **Studies of development in long shoots and short shoots of *Ginkgo biloba* L. IV. Growth habit, shoot expression and the mechanism of its control.** *Amer. J. Bot.* 36 (3), 1949 (309-16). 7 refs. [Rutgers University, New Brunswick, N.J., and Harvard University Cambridge, Mass.] O.B.D.

87. **Diurnal elongation of the shoots and roots of *P. radiata*.** *Rep. For. Timb. Bur. Aust.* 1947, 1948 (12-3).

Measurements have shown that the rate of elongation of both foliage, shoots and roots of *Pinus radiata*, is in general much greater at night than during the day, and that changes in length of the shoot and the root and in the diameter of the trunk are closely related. It was also shown that the diurnal rate of growth is related to atmospheric temperature, and that the rate of growth at night is strongly influenced by the minimum temperature.

Other dendrometric investigations being carried out cover the relation between the rate of elongation of the top and roots of Eucalypt seedlings, the distribution of increment along the stem of *P. radiata*, and the distribution of diameter increment throughout the year in different localities in the Australian Capital Territory.

12.11.3. Heredity. Breeding.

Hybridization. Races and Questions of Provenance. Cytology

See also *For. Abstr.* 11 (Nos. 124, 683).

88. AMINOFF, F. Krogerup i Danmark: en anläggning för skogsträdsförädling. [Krogerup, Denmark: an establishment for forest tree breeding.] *Skogen* 35 (20), 1948 (233). [Sw.]

The Danish Forest Service's station at Krogerup, Sjælland, was established a few years ago with the aim of putting into practice the results of C. Syrach Larsen's work at Hørsholm and eventually supplying the whole of the State forests with improved stock, an object which may possibly be achieved in some 15 years' time. About 65 ha. of land are available and nurseries have been established where, by

budding or grafting, the bulk of the trees needed to form seed plantations in the various districts will be produced. The remainder of the Krogerup area is to be given over to clonal stands of selected strains of various species. In spring, 1947, a start was made with 18 clones of Larch, to be supplemented in 1948-9 with a further 20 clones. In addition, 13 clones of Ash have been established and the programme includes similar plots of Silver Fir, Norway Spruce and Douglas Fir. These plots will serve to keep the strains in existence for seed supplies and for continuous study of the biological and other characters of the clones.

89. KURATA, M. **The identification of races of useful tree species by type of [stem and leaf] hair.** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 40, 1948. pp. 148. [Jap.e.],

The author claims to have confirmed the existence of 3 races of Mitsumata (*Edgeworthia papyrifera*), hitherto identifiable with difficulty by such superficial characteristics as leaf size and bark colour, on the basis of the number of papillae occurring on the hairs of leaf and stem. The Kagimata and Aoki races gave distribution curves with modes of 13-16 and 9 respectively; the Akagi, a curve with a mode of 0. The average number of papillae per hair was respectively 15, 9 and 3, 20-27% of the Akagi hairs having no papillae at all. These differences hold true from the early seedling stage.

Similarly, with Abemaki (*Quercus variabilis*), peelable races (Abe) can readily be distinguished from the unpeelable (Mizuabe) by the density and number of cells of the stellate hairs. In Abe, the hairs are thick and typically 8-celled; in Mizuabe, sparse and typically 4-celled.

90. CÂMARA, A., and ALICINDA DE JESUS. Um estudo citológico de *Cupressus lusitanica* Miller. [A cytological study of *Cupressus lusitanica*.] *Agron. lusit.* 8 (2), 1946 (95-122 + 4 plates). 17 refs. [Port.port.e.]

Counts of chromosomes of *Cupressus lusitanica* during mitosis and meiosis showed the basic number to be 11. Numerous chromosomal variations were found in meiotic divisions, and it is thought that these variations must be very common as a consequence of free pollinations, probably with plants of the same species, but of different genomic constitution. The view is expressed that the high polymorphism of *C. lusitanica* is in some cases a result of

structural variations of the chromosomes. *From authors' summary.*

91. DELEVOY, G. *Larix eurolepis* A. Henry et M. Flood. *Bull. Soc. for. Belg.* 56 (5), 1949 (178-94). 21 refs. [F.]

A general account of the hybrid Larch with particular reference to its performance in Belgium and a key for identification of European, Japanese and hybrid Larches.

92. DELEVOY, G. Influence de l'origine des graines d'épicéa. Note préliminaire relative à l'essai international 1937. [Influence of the seed origin of Spruce. Preliminary report on the 1937 international trial.] *Bull. Soc. for. Belg.* 56 (4), 1949 (129-41). 6 refs. [F.]

An interim report on the Belgian results of a provenance test for Norway Spruce organized by the Union of Forest Research Organizations. Best results were obtained at Groenendael with seed of Baltic and central European origin. A table gives data for seed of 14 different provenances, as follows:—Latitude, altitude, botanical region (Braun-Blanquet) and Spruce region (Rubner) of place of origin; weight of 1,000 seeds; germination %; water content of 1-year seedlings raised at Zürich, at Groenendael, in Poland, in Scotland, and in Finland.

93. [Controlled pollination and single parent studies with *Pinus taeda* and *P. caribaea*.] *Rep. Qd. For. Serv.* 1947-8, 1948 (5).

Stock from open-pollinated good parent trees has yielded about twice the percentage of stems of good form produced by stock resulting from general collection. The percentage is further increased with stock from controlled pollination, which gives up to 4 times as many stems of good form. If confirmation of these results is secured in the routine field plantings now under way, wider initial spacing will be adopted.

94. MACHADO, D. P. Indução de poliploidies no *Pinus pinaster* Sol. e no *Quercus suber* L. [Induction of polyploidy in *Pinus pinaster* and *Q. suber*.] *Separate from An. Inst. Agron., Lisboa* 14, 1943 (185-8 + 3 photos). [Port.]

95. WRIGHT, J. W. **Local genetic variation in Silver Maple.** *J. For.* 47 (4), 1949 (300-2).

Open-pollinated seed from 9 wild *Acer saccharinum* trees in 4 different localities of

Indiana was tested for variation. After 2 years the progenies showed no significant difference in height or diameter, but did show marked variation in branchiness and frost-tenderness.

96. JOHNNSSON, H. **Studies on Birch species hybrids. I. *Betula verrucosa* × *B. japonica*, *B. verrucosa* × *B. papyrifera* and *B. pubescens* × *B. papyrifera*. *Hereditas*, Lund 35 (2), 1949 (115–35). 15 refs. [Forest Tree Breeding Institute, Ekebo, Kallstorp.] O.R.S.**

The increment, morphological characters, meiotic conditions and fertility have been studied of the F_1 hybrids *Betula verrucosa* ($2n = 28$) × *japonica* ($2n = 28$), *B. verrucosa* ($2n = 28$) × *papyrifera* ($2n = 84$), and *B. pubescens* ($2n = 56$) × *papyrifera* ($2n = 84$). All three hybrids possess a manifest heterosis and, in general, features intermediate between the parent species. Meiosis is regular in *B. verrucosa* × *japonica* and *B. verrucosa* × *papyrifera*, while a high univalent frequency occurs in *B. pubescens* × *papyrifera*. The conclusion has been drawn that the genomes of *B. verrucosa* and *B. japonica* are structurally identical, that one of the *B. papyrifera* genomes is identical with the *B. verrucosa* one, and that the other two genomes in 84-chromosomal *B. papyrifera* are identical with each other. Diplontic male-sterility occurs in *B. verrucosa* × *japonica* and in *B. verrucosa* × *papyrifera*. Both morphologically and functionally these two hybrids otherwise possess a good pollen. The pollen fertility of *B. pubescens* × *papyrifera* is considerably reduced. The female fertility is high in *B. verrucosa* × *japonica*, much reduced in *B. verrucosa* × *papyrifera*, and *B. pubescens* × *papyrifera* is practically female sterile. The importance of the fertility of the hybrids when use is made of F_1 populations with hybrid vigour in forestry practice is discussed. The chromosome number of *B. papyrifera* fluctuates between 70 and 84. The number $2n = 84$ is not restricted to *B. papyrifera* var. *occidentalis*. The taxonomic conditions within the genus *Betula* are discussed and the possibilities of experimental taxonomy yielding valuable contributions to the clarification of species-limits within a critical genus are suggested. *Author's summary*.

97. TJIO, J. H. **Notes on nucleolar conditions in *Ceiba pentandra*. *Hereditas*,**

Lund 34, 1948 (204–8). 5 refs. [Swedish Seed Association, Svalöf.] O.R.S.

98. ATCHISON, E. **Studies in the Leguminosae. II. Cytogeography of *Acacia* (Tourn.) L. *Amer. J. Bot.* 35 (10), 1948 (651–5). 12 refs. O.B.D.**

Chromosome numbers were determined for approximately 38 species and varieties of the genus *Acacia*. Thirteen species and varieties are polyploid with $2n = 52$, the remainder diploid with $2n = 26$. The degree of polyploidy and morphological adaptation in *Acacia* either in taxonomic sections of the genus or geographical areas, does not support a linear evolution for these groups. Rather, it is to be concluded that the primitive and widespread section Gummiferae, containing at present diploid and tetraploid species as well as the primitive morphological characters of the genus, independently gave rise to the diploid Australian sections, the diploid American sections, and the polyploid African species. The number of species subsequently occurring in the African, American and Australian regions supports them as later centres of specific diversification, but contributes on evidence toward a geographical location for the primary origin of the genus. Polyploid *Acacias* do not have a more northern distribution or a wider dispersal than diploids. They have not demonstrated a greater degree of hardiness. There are no obvious morphological differences which distinguish polyploids from diploids. *From author's summary*.

99. PHILP, J., and SHERRY, S. P. **The genetics of hybrids between Green Wattle (*Acacia decurrens*) and Black Wattle (*Acacia mollissima*). *J. S. Afr. For. Ass.* No. 17, 1949 (6–58). 19 refs.**

Hybrids were between Green and Black Wattle and studies carried out of the parents, the hybrids, a natural hybrid and its natural progeny. The genetic evidence supports the current view that Black and Green Wattle are distinct species. Breeding programmes for the production of improved strains of Wattle are outlined.

100. HEDLUND, T. **Om uppkomsten av nya livstyper inom släktet *Sorbus*. [On the rise of new biotypes within the genus *Sorbus*.] *Bot. Notiser* No. 4, 1948 (381–92). [Sw.e.] O.B.D.**

101. ROST, H. Ante el problema de la celulosa. Híbridos del género *Populus* de rápido crecimiento. [The cellulose problem. Fast growing *Populus* hybrids.] *Montes, Madrid* 4 (24), 1948 (511-20); 5 (25), 1949 (23-33). [Span.]

Summarizes work on Poplar hybrids in Europe and the U.S.A. and outlines a new method of Poplar propagation, whereby plantings can continue throughout the period of growth, and cuttings taken in summer can be planted straight away. Using this method, instead of having a team of men planting for a short period in April only, planting can go on with far fewer hands, throughout the year. The day before planting, cuttings are put in water and left overnight, to be taken out the next day and dried superficially. The upper part is then submerged in melted paraffin wax or similar substance. With the aid of a tractor and plough 2 men can plant 0.8 ha. at a spacing of 6×6 ft. in a day; on uneven ground, and by hand, 0.4 ha. per day. At the end of the second or beginning of the third year the soil should be loosened and cleared of weeds for a radius of 2 ft. around the tree. At the end of the third year the tree is pruned up to a third of its height and in the fifth year up to a height of 10-12 ft. Thinnings will probably be necessary in the seventh or eighth year, and the stand is felled in the eleventh year. Regeneration is by coppice which is later thinned out to the number of original stand. In the second 10-year cycle no working of the soil is necessary, but severe thinnings and prunings must be done. Some data on yield, costs and income from stands treated according to these methods in Sweden and the U.S.A. are included.

102. WRIGHT, J. W. Producing Elm seeds on cut branches. *J. For.* 47 (3), 1949 (210-4). 4 refs. [Northeastern Forest Experiment Station.]

Studies were made of cut branches of *Ulmus americana*, and *U. fulva*, and a few tests also with *U. pumila*, *U. glabra*, *U. glabra* var. *camperdownii*, and *U. carpinifolia* f. *sarniensis*. Dormant flowering branches, 4-5 ft. long and $\frac{1}{2}$ -1 in. in diameter, were collected at various times during 3 winters in Indiana, kept moist in transit to a greenhouse (not more than 4 hours) where they were set 6 in. deep in various moisture-retaining media (sand soil, sand-peat, and water). No attempt was made to root the

branches and none rooted. The flowers were pollinated by shaking flowering branches in their vicinity. The tests were made under several temperature conditions; in greenhouses having temperature ranges of 52-65° and 65-70° F., in a high-humidity orchid house kept at 70°, and in a laboratory kept at about 72°. With *U. fulva* reasonable success was obtained with branches brought in as early as mid-February, but with *U. americana* no fruits were matured from material collected more than 2 weeks before normal anthesis outside. Optimum branch size for both species was 1-3 ft. long pruned to a top diameter of $\frac{1}{4}$ in. Such material usually has a basal diameter of $\frac{3}{8}$ - $\frac{1}{2}$ in. and bears only 1-2 short flower-bearing laterals. Single branches often bore up to 15 good seeds. Best results were obtained in the cool greenhouse for material collected in February, and in the 65-70° greenhouse for material collected later. With branches of both species collected in late March, mature seeds were obtained 21-27 days after the start of anthesis, compared with 35-50 days outside. By using indoor pollination, the breeder can extend his breeding season by 2-8 weeks, pollinate early-blooming by late-blooming trees, work trees from several localities at the same time and prevent loss by unfavourable weather.

12.11.6. Phenomena of Movement

See also *For. Abstr.* 11 (No. 76).

103. BRAUNER, L., and BRAUNER, M. Untersuchungen über den Mechanismus der phototropischen Reaktion der Blattoberflächen von *Robinia pseudoacacia*. [Experiments on the mechanism of phototropic reactions of leaflets of *Robinia pseudoacacia*.] *Revue de la Faculté des Sciences de l'Université d'Istanbul, Série B* 12 (1), 1947 (35-79). 31 refs. [G.turk.e.] L.B.M.N.

12.13. Embryology

104. ELLIOTT, C. G. The embryogeny of *Phoradendron hookerianum*. *Proc. Linn. Soc. N.S.W.* 55 (3/4), 1948 (120-9). 23 refs. D.S.I.R.

105. STERLING, C. Embryonic differentiation in *Taxus cuspidata*. *Bull. Torrey bot. Cl.* 76 (2), 1949 (116-33). 40 refs. [University of Wisconsin, Madison.]

106. DOLCHER, T. Ricerche embriologiche sulla famiglia delle Rhamnaceae. [Embryological studies in the Rhamnaceae.] *Nuovo G. bot. ital. (n.s.)* 54 (3/4), 1947 (648-73). 16 refs. [It. it. e.g.] O.B.D.

Deals with *Rhamnus alaternus*, *Colletia cruciata*, *C. spinosa*, *Paliurus aculeatus*, and *Hovenia dulcis*.

12.14. Organography. Morphology. Anatomy. Histology

See also *For. Abstr.* 11

(Nos. 84-6, 124, 158, 161-2, 561).

107. DODD, J. D. On the shapes of cells in the cambial zone of *Pinus sylvestris*. *Amer. J. Bot.* 35 (10), 1948 (666-82). 35 refs. O.B.D.

In 50 cells of *Pinus sylvestris* studied, a variation of 8-32 faces per cell was found, the average being 18 faces per cell. There are 3 distinct classes of face, tangential, ray-cell and lateral cambial faces. An average cell might be postulated as having 2 tangential faces, 12 lateral cambial faces arranged 6 on one side and 6 on the other, and 4 ray-cell faces arranged as 2 ray contacts of 2 faces each. The average cell would be long, pointed at both ends and tangentially flattened. In considering this it may be noted that a fusiform cambial cell is in contact with 14 others like itself. The ray-cell faces must be taken into account in determining cambial cell shape, but the spatial distribution of the fusiform cambial cells with respect to each other is similar to that found for undifferentiated cells in homogeneous tissue. A discussion of some of the factors responsible for the great variations in the shapes of cambial cells is presented. *From author's summary.*

108. HUBER, B., and KOLBE, R. W. Elektronenmikroskopische Untersuchungen an Siebröhren. [Investigations of sieve tubes of *Pseudotsuga taxifolia*, *Betula verrucosa* and *Robinia* sp.] with an electron microscope.] *Svensk. bot. Tidskr.* 42 (4), 1948 (364-71 + 7 photos). 7 refs. [G.g.] O.B.D.

109. LARSEN, V. R. JR. The origin and development of the latex system in seedlings of *Cnidoscolus tepiquensis*. *Abstr. in Amer. J. Bot.* 35 (10), 1948 (795). [Barnard College, Columbia University, New York.] O.B.D.

110. MACHADO, D. P. Ontogenia do periciclo nos ramos da *Quercus suber*, L. [Ontogeny of the pericycle in branches of *Quercus suber*.] *Repr. from Agros* 31 (5-6), 1948. pp. 6 + 4 photos. 11 refs. [Port.]

111. DITTMER, H. J., and REINHART, J. Root hair development on gymnosperm seedlings. *Abstr. in Amer. J. Bot.* 35 (10), 1948 (791). [University of New Mexico, Albuquerque.] O.B.D.

A comparative study was made of the roots and root hairs of 5 genera and 6 species of gymnosperm seedlings grown in the laboratory under different soil conditions. The species studied produced greater numbers of roots in an infertile alkaline soil than in forest soil which was of greater fertility and much lower pH. Distribution of roots was not uniform in the different species, some exhibiting greater growth in roots of the secondary division, others in the tertiary. Root hairs were found on all plants examined and were most abundant on the lateral roots. The number of root hairs produced on these 6 gymnosperm species was much less than those previously reported in over 35 angiosperm species, and the hairs were not uniformly distributed as usually found on the angiosperms. Some characteristics of the root systems, which seemed relatively stable within any one species, yet which varied between species, were observed.

112. GUTTENBERG, H. VON. Studien über die Entwicklung des Wurzelvegetationspunktes der Dikotyledonen. [Studies of the development of the root growing-point of dicotyledons.] *Planta* 35 (3/4), 1947 (360-96). 17 refs. [G.] O.B.D.

113. MARLIER-SPIRLET, M. L. Sur quelques épidermes de feuilles de *Cinnamomum* L. [The epidermis of the leaves of some species of *Cinnamomum* L.] *Bull. Jard. bot. Brux.* 17 (3/4), 1945 (266-305). 6 refs. [F.] E.B.

A description of the leaf epidermis of 18 species of *Cinnamomum*.

114. GAUTHIER, R. L'occurrence de cônes hermaphrodites sur un *Picea glauca*. [The occurrence of hermaphrodite cones on a *Picea glauca*.] *Annales de l'ACFAS, Montréal* 12, 1946 (75). [F.] L.B.M.N.

Hermaphrodite cones were found on a *P. glauca* grown in the Botanic Garden at Montreal, after a spring of very variable temperatures. The tree was in fairly good condition.

115. MÜLLER-STOLL, W. R. Zytomorphologische Studien am Pollen von *Taxus baccata* L. und anderen Koniferen. [Cytomorphological studies of pollen of *T. baccata* L. and other conifers.] *Planta* 35 (5/6), 1948 (601-41). 40 refs. [G.g.] O.B.D.

116. DÄNIKER, A. U. Die Tendenz zur Fruchtbildung bei einer Gymnosperme, *Dacrydium araucarioides* Brongniart et Gris. [The tendency to fruit formation in a gymnosperm, *Dacrydium araucarioides* Brongniart et Gris.] *Berichte der schweizerischen botanischen Gesellschaft*, Zürich 51, 1941 (475-8). [G.] Ld.U.

117. FERRÉ, Y. DE. Morphologie des graines de gymnospermes (Suite I). [Morphology of the seeds of gymnosperms (Series I).] *Bulletin de la Société d'Histoire naturelle de Toulouse* 79, 1944 (73-80). [F.] E.B.

A brief description of the seeds of 27 species.

118. INGRAM, C. Leucism in the bark of trees in sunny climates. *Gardeners' Chronicle*, London 123 (3202), 1948 (164). O.B.D.

An intense silvery whiteness is characteristic of the bark of some imported and indigenous trees in Cyprus. It is particularly pronounced in the case of *Populus nigra*, *Prunus avium*, *Platanus orientalis* and (to a lesser extent) of *Ficus carica*. Samples of bark of *P. avium*, examined by Dr. R. W. Philipson of the British Museum, showed that the external bark layers persist much longer in Cyprus than in England, so that the bark becomes thick and compact with a series of superimposed cork layers. The silvery whiteness is thought to be due to air having entered between the very thin, compressed layers. Whiteness of bark in other species in sunny climates is a well known phenomenon and invites investigation.

12.19. Geographical Distribution. Plant Geography and Sociology

See also *For. Abstr.* 11
(Nos. 15, 152-3, 183, 196, 591).

119. GATES, F. C. *Field manual of plant ecology*. McGraw Hill Book Co., Inc., New York, 1949. pp. xv + 137. Price 18s.

Directions for exercises in plant ecology, based on the course taught at the University of Michigan Biological Station.

120. RIKLI, M. Das Pflanzenkleid der Mittelmeerländer. [The vegetation of the Mediterranean countries.] Verlag Hans Huber, Bern. Vol. 3, 1948. pp. viii + 1095-1418. Numerous refs. [G.]

Cf. *For. Abstr.* 8 (No. 2304). The present volume, which concludes the work, contains a list of the author's travels in the region, a list of illustrations and maps in the preceding volumes, a bibliography of all the important literature on the region, indexes to personal names, topographical and ethnographical names, and a combined species and subject index. An appendix lists corrigenda to the earlier volumes.

121. ROBYNS, W. Sur l'existence du *Juniperus procera* Hochst. au Congo Belge. [The existence of *J. procera* in the Belgian Congo.] *Bull. Jard. bot. Brux.* 18 (1/2), 1946 (125-31). 4 refs. [F.] E.B.

A small group of *Juniperus procera* was found in the upper Katanga district in the Belgian Congo at the southern limit of the Marungu. The trees grow on shallow, dark sand, seemingly very dry, with a moderately rich layer of humus, among *Protea consensis* and *Philippia benguelensis*, with an understorey composed of Gramineae and other plants. The indications were that *J. procera* is indigenous to the region, but is in process of dying out. This discovery extends the distribution of the species considerably to the west. Seedlings occur mostly in clearings or at the forest edge, in association with *Hypericum lanceolatum*. It seems that *J. procera* might prove valuable in reforesting the denuded, grassy regions of the Marungu.

122. DOORENBOS, J. De verspreiding van het geslacht *Acer* in Europa. [The distribution of the genus *Acer* in Europe.] *Jaarb. ned. dendrol. Ver.* 16, 1947 (41-7 + 5 sketches). 10 refs. [Du.]

123. BROYER, C., and LENOBLE, F. Note complémentaire sur la distribution du *Buxus sempervirens* en France. [Additional note on the distribution of *B. sempervirens* in France.] *Bull. Soc. bot. France* 95 (5/6), 1948 (21-89). [F.] O.B.D.

Cf. *For. Abstr.* 9 (No. 132).

124. OCCHIONI, P. Contribuição ao estudo da família 'Canellaceae'. [Contribution to the study of the Canellaceae.] *Arquivos do Jardim botânico do Rio de Janeiro* 8, 1948 (3-165). 100 refs. [Port.port.] P.R.

Consists of:—(1) a historical survey of the taxonomy of the family Canellaceae, with a brief outline of its geographical distribution; (2) a comprehensive study of *Cinnamodendron axillare*, its morphology, histology, anatomy, cytology and chemical composition; and (3) a description of the habitat of *C. axillare* in Brazil, i.e. climate, geology and associated vegetation. All sections contain bibliographies.

125. OCCHIONI, P. Nota sobre a biologia das Canelaceas brasileiras. [Note on the biology of the Brazilian Canellaceae.] *Arquivos do Jardim botânico do Rio de Janeiro* 8, 1948 (275-9). [Port.f.] P.R.

Some observations on the part played by various biological factors in the regeneration in Brazil of *Cinnamodendron sampaioanum*, which produces in June and July an abundance of fruit quite out of proportion to the paucity of young trees found around the parent tree. It was found that the fruit is attacked by the larvae of an unidentified dipterous insect which destroys the endosperm and prevents germination or development of the seedlings. The fruits are also much favoured by a bird called locally 'Jacu' (probably *Penelope superciliosus jacupemba*) which carries the seeds long distances from the parent tree, where they usually germinate successfully.

126. SMITH, A. C. The occurrence of *Degeneria vitiensis*. *Abstr. in Amer. J. Bot.* 35 (10), 1948 (816). [Arnold Arboretum, Harvard University, Jamaica Plain, Mass.] O.B.D.

Degeneria vitiensis was found in some frequency in the interior of Viti Levu in 1947, and 55 trees of the species were examined. It is a tree of the primary rain forest which covers the south-eastern slopes of the two large islands of Fiji. This rain forest, between sea level and 900 m., is associated with very equable climatic conditions; the mean temperature ranges between 68 and 77° F. and the rainfall between 120 and 213 in. per year. Vegetational aspects of this rain forest are discussed and illustrated. [Cf. *For. Abstr.* 5 (244).]

127. ANIĆ, M. Pitomi kesten u Zagrebač-koj gori. [Sweet Chestnut in the Zagrebačka Gora.] *Glasn. šumske Pokuse* 7 (2), 1940 (103-312 + 32 photos + 1 map + 1 tbl.). 116 refs. [Croat.g.]

A study of *Castanea sativa* in the Zagrebačka Gora, its distribution, the geomorphological, climatic and edaphic conditions, and the plant associations in which it is found. A comparative account of the silvicultural requirements of Chestnut, both for wood and nut production, is included.

12.19.2-3. Vegetation Types

See also *For. Abstr.* 11

(Nos. 185, 783, 812).

128. PICH-SERMOLI, R. E. An index for establishing the degree of maturity in plant communities. *J. Ecol.* 36 (1), 1948 (85-90). [E.it.]

The author proposes the use of a 'maturity index' in the evaluation of plant communities. This index is the quotient of the total of the frequency percentages of all the species in the community divided by the number of the species; the more highly developed the community, the nearer to 100 will be its maturity index. Possible uses of this index are briefly indicated.

129. WILLANDER, K., and SCHLEIDT, W. Vegetationsverhältnisse in einem ursprünglichen Flyschgebiet. [Vegetation in an original flysch region [in Austria].] *Umwelt* No. 2, 1947 (54-5). [G.] A.P.B.

130. MACHURA, L. Urwald unserer Heimat. [The primitive forest of Austria.] *Umwelt* No. 3, 1947 (102-5). [G.] A.P.B.

131. FREI-SULZER, M. Erste Ergebnisse einer biocoenologischen Untersuchung schweizerischer Buchenwälder. [Preliminary results of a biocoenological investigation of the Swiss Beech forests.] *Berichte der schweizerischen botanischen Gesellschaft, Zürich* 51, 1941 (479-530). 72 refs. [G.] L.D.U.

132. WIGG, L. T. The urgent need for uniformity in African vegetation description. *Emp. For. Rev.* 28 (1), 1949 (14-7). 3 refs.

It is proposed that a co-ordinating committee should be formed to lay down a uniform description of vegetation for Africa as a whole,

and it is suggested that a basis for such classification already exists in Shantz and Marbut's *Vegetation and soils of Africa*.

133. ANDREWS, F. W. **The vegetation of the Sudan.** Pp. 32-61, + 9 photos, in Tothill, J. D., *Agriculture in the Sudan*, Oxford University Press, London, 1948. 12 photos. 1 map. O.R.E.

Cf. *For. Abstr.* 11 (No. 32).

134. AUBREVILLE, A. Climats, forêts et désertification de l'Afrique tropicale. [*Climates, forests, and the formation of desert in tropical Africa.*] Société d'Éditions géographiques, maritimes et coloniales, 17 Rue Jacob, Paris VIe. 1949. pp. 351. 281 refs. [F.] Price 3,200 frs.

The first 80 pages are devoted to the fundamentals of tropical forest ecology; pp. 81-200 to the causes, statistics and classification of the climates of tropical Africa; pp. 201-308 to the classification of the principal forest types of tropical and subtropical Africa; pp. 309-44 to the progressive trend towards the formation of desert in tropical Africa. The author lays particular emphasis on the way in which the various forest types are adapted to different bioclimates, and how the latter are being gradually transformed by the destructive action of man.

135. JAEGER, P., and ADAM, J. G. Aperçu sommaire sur la végétation de la région occidentale de la dorsale Loma-Man. La galerie forestière de la source du Niger. [*Brief review of the vegetation of the western region of the Loma-Man elevation. The fringing forest of the Niger's source.*] *Bull. Soc. bot. France* 94 (7-8), 1947 (323-37). 26 refs. [F.] O.B.D.

136. SCHNELL, R. Observations sur l'instabilité de certaines forêts de la Haute-Guinée française en rapport avec le modelé et la nature du sol. [*The instability of certain forests of French Guinea in relation to relief and the nature of the soil.*] *Bull. agric. Congo belge* 40 (1), 1949 (670-6). 8 refs. [F.]

Deals mainly with the vegetation on soils of a lateritic type and the part played by such soils in the formation of savannas.

137. BRYNAERT, J., and TOUSSAINT, L. Étude pédo-botanique et propositions d'aménagement agricole et forestier des savanes dégradées de la région nord de Matadi. [*Pedological and botanical study, and suggestions for the agricultural and silvicultural management of degraded savannas of the northern Matadi region.*] *Bull. agric. Congo belge* 40 (1), 1949 (546-74). [F.]

138. CHEVALIER, A. Biogéographie et écologie de la forêt dense ombrophile de la Côte d'Ivoire. [*Biogeography and ecology of the dense rain forest of the Ivory Coast.*] *Bull. agric. Congo belge* 40 (1), 1949 (717-32). [F.]

Mainly a review of literature.

139. GILLMAN, C. **A vegetation-types map of Tanganyika Territory.** *Geography, New York* 39 (1), 1949 (7-37 + map). O.G.

An account is given of the methods and data used in compiling the map. Eight physiognomic vegetation types were adopted:—(1) forest, (2) woodland, (3) bushland and thicket, (4) wooded grassland, (5) grassland, (6) permanent swamp, (7) desert and semi-desert, and (8) vegetation actively induced by man. During the compilation it was found necessary to introduce two intermediate types to fit observed facts, one between (1) and (2), and one between (2) and (3/4). Descriptive notes are given on each type.

140. WIEHE, P. O. **The vegetation of Rodriguez Island.** *Mauritius Inst. Bull.* 2 (5), 1949 (279-304 + 2 maps). 23 refs.

141. LIVINGSTON, R. B. **An ecological study of the Black Forest, Colorado.** *Ecol. Monogr.* 19 (2), 1949 (123-44). 26 refs.

As a result of detailed study, it is concluded that climatic factors do not determine the distribution of arborescent communities in this region. The differences in precipitation, temperature, and evaporation rates between forest, chaparral and grassland communities are probably the result, and not the cause, of vegetational differences. The presence of coarse-textured soils determines the distribution of arborescent communities in the region. More rapid infiltration, reduced run-off, and lower wilting percentages in such soils, together with a conglomerate substrate that produces a

'suspended water table' make for mesic environments where trees and shrubs are able to survive. *From author's summary.*

142. RAWITSCHER, F. **The water economy of the vegetation of the 'campos cerrados' in Southern Brazil.** *J. Ecol.* 36 (2), 1948 (237-68). 58 refs. Also in *Cienc. e Invest.*, B. Aires 5 (3/4), 1949 (107-16; 140-7). [Span.] A.P.B.

This study was undertaken in order to determine whether the poor, stunted vegetation of the *campos cerrados* of Brazil must be ascribed to the dryness of the climate, or to human interference (especially annual burning).

The depth of the soil is very great and a continuous underground water level occurs at 17-18 m. Drought at the rainless period affects only the top layers to 2-2.5 m. Below that, the soil is always wet, and excess water drains off all the year round. This abundance of groundwater, and the fact that in undisturbed areas under similar conditions, there still exist forests of a rather hygrophytic character, lead to the conclusion that the *cerrados* are not the natural vegetation of this region, but a fire climax. Study of the transpiration etc. of the small trees and shrubs revealed no xerophytic characters. [Cf. *For. Abstr.* 9 (No. 145).] *From author's summary.*

143. **Forest reconnaissance of the Kaburi-Potaro area [in British Guiana].** *Rep. For. Dep. Brit. Guiana* 1947, 1948 (9-10).

Five major forest types are described—Xerophytic forest represented by Wallaba [*Eperua* spp.] and by clump Wallaba forest; rain forest; swamp rain forest; and marsh forest.

144. HOLLOWAY, J. T. **Ecological investigations in the *Nothofagus* forests in New Zealand.** *N.Z. J. For.* 5 (5), 1948 (1949), (401-10). 3 refs. [Paper read at the 7th Pacific Science Congress, Christchurch, Feb. 1949.]

A short account is given illustrative of the structural complexity of the forests, with an indication of the habitat and site preferences of the various species of *Nothofagus*. Studies of selected forests are in progress in order to provide information of immediate value in the field of forest management and silviculture.

Arising out of these more detailed studies, it has been possible to formulate hypotheses concerning the general distribution of the forests and

their inherent stability. In particular these hypotheses have reference to climatic instability and the re-distribution of the various forest associations now in progress.

Investigations are also in progress with relation to the effect upon the vegetation of populations of exotic animals. The conclusion has been reached that the only permissible objective, at least in respect to *Nothofagus* forests, is the complete extermination of such animals coupled with the preparation of remedial measures should extermination prove impossible. *Author's summary.* [Cf. *For. Abstr.* 11 (No. 192).]

12.19.4. Succession

See also *For. Abstr.* 11
(Nos. 18-9, 136, 142, 206, 223, 663).

145. DUCHAUFOUR, P. **Note sur la végétation des dunes calcaires de l'île d'Oléron (forêt domaniale de Saint-Trojan). [The vegetation of the calcareous dunes of Oléron Island (state forest of Saint-Trojan).]** *Bull. Soc. bot. France* 95 (5/6), 1948 (202-5). [F.] O.B.D.

Reviews different stages in the colonization of sand dunes in this region, where the sand is calcareous and is rich in various silicates and not exclusively in quartz, as in the Landes. Where no forest soil has yet been formed the calcareous nature of the sand appears to discourage vegetation, the initial associations being poorer than those on quartzose sand. On the other hand, in the older colonizations, with a soil rich in neutral humus, many more exacting species appear to find favourable conditions, and the climax association is very different from that of the purely siliceous dunes, notably in the absence or rarity of *Quercus toza*, *Arbutus unedo* and most of the Ericaceae, except *Erica scoparia*. Maritime Pine, which regenerates well, is often malformed and frequently shows signs of chlorosis.

146. BROWNE, F. G. **Storm forest in Kelantan.** *Malay. Forester* 12 (1), 1949 (28-33).

About the year 1881 the northern part of Kelantan was struck by a hurricane which largely destroyed the virgin Dipterocarp forests. The author gives some account of the present secondary growth, which is inexplicably patchy, Dipterocarp regeneration being either very good or very bad with no intermediate

qualities. The only species represented by pre-hurricane trees is *Dipterocarpus lowii*.

147. WICHT, C. L. A statistically designed experiment to test the effects of burning on a sclerophyll scrub community. I. Preliminary account. *Transactions of the royal Society of South Africa, Cape Town* 31 (5), 1948 (479-501 + 8 plates). 27 refs. O.R.S.

Describes an experiment made at the Jonkershoek Forest Influences Research Station, Stellenbosch, designed to test the effects of burning in different months on a sclerophyll scrub community. Burnings of experimental plots were made on the 15th day of the following months: Jan. to April; Sept. to December. Full analyses of the vegetation were made before burning, and the statistics are presented and discussed. The results of burnings made in January to April, as observed in the following winter and spring, are given. A general conclusion was drawn that burning in summer and autumn will generally promote flowering towards the end of winter and in the spring of *Oxalis* species, other geophytes, and probably some therophytes also, but that such burning prevents the flowering, for one season at least, of many perennial shrubby species, especially those which regenerate from seed. It also seemed probable that late burning in autumn was more unfavourable for flowering in spring than burning in mid-summer.

148. LEMON, P. C. Successional responses of herbs in the Longleaf/Slash Pine forest after fire. *Ecology* 30 (2), 1949 (135-45). 26 refs.

A greater number of species participate in the ground cover in the first 3 years following a fire than after 8 years of fire protection. The greater variety of forage plants on a fresh burn is probably a dietary advantage to cattle. Various morphological adaptations seem to be of value for rapid aggregation of plants on burns. Many of the fire-followers have a large number of small seeds, frequently wind-borne, supplemented by rhizomes, crown-buds and tillers. *From author's summary.*

149. LITTLE, S., and MOORE, E. B. The ecological rôle of prescribed burns in the Pine-Oak forests of southern New Jersey. *Ecology* 30 (2), 1949 (223-33). 30 refs.

Fire favours the regeneration of the desirable subclimax Shortleaf and Pitch Pine at the expense of the less desirable climax hardwood forest dominated by Oaks.

12.2. Special (Systematic) Botany

12.21. Fungi

150. WATERSTON, J. M. The fungi of Bermuda. *Bulletin, Department of Agriculture, Bermuda* No. 23, 1947. pp. 305. 16 pages of refs. P.R.

Consists of a chronological review of mycological work in Bermuda, notes on collecting stations, seasonal incidence of species, fungi absent from Bermuda, and geographical distribution, a statistical summary, lists of species, and index of hosts and fungi.

12.25. Gymnosperms

151. ARNOLD, C. A. Classification of Gymnosperms from the viewpoint of paleobotany. *Bot. Gaz.* 110 (1), 1948 (2-12). 5 refs. [University of Michigan.] O.B.D.

152. BUCHHOLZ, J. T. Generic and sub-generic distribution of the Coniferales. *Bot. Gaz.* 110 (1), 1948 (80-91). 9 refs. [University of Illinois, Urbana.] O.B.D.

153. LINDQUIST, B. The main varieties of *Picea abies* (L.) Karst. in Europe, with a contribution to the theory of a forest vegetation in Scandinavia during the last Pleistocene glaciation. *Acta Horti Bergiani* 14 (7), 1948 (249-342). 180 refs. [E.]

Reviews literature on morphological variations in *P. abies* and gives details of the author's original studies in this field, with special reference to variation in shoot pubescence and the geographical distribution of the chief morphological variants. Discusses the findings and concludes that the main varieties are: *P. abies* (the type, of Scandinavia and N.E. Europe), *P. a. var. obovata* (Siberian Spruce), *P. a. var. germanica* Lindquist, var. nov. (the Central European form), and *P. a. var. arctica* Lindquist, var. nov. (of N.W. Scandinavia and Russian Lapland).

To this taxonomic study is appended an account of the immigration of *P. abies* into Scandinavia after the last glaciation, with some

notes on Scandinavian glacial refuges and their tree vegetation.

12.26-8 Dicotyledons

See also *For. Abstr.* 11
(Nos. 89, 124, 329).

154. MAGINI, E. Il riconoscimento delle piantine allo stato giovanile. (B) Il riconoscimento delle piantine di latifoglie: (β) Latifoglie con cotiledoni epigei. [The identification of seedlings in an early stage of development. (B) The identification of broadleaved seedlings: (β) Epigeal species.] *Ital. for. mont.* 4 (1), 1949 (41-8). [It.]

Cf. *For. Abstr.* 10 (No. 1675).

155. ARNBORG, T. Vad ska vi kalla våra björkar? [What shall we call our Birches?] *Skogen* 35 (22), 1948 (258-9). [Sw.]

Considers the Swedish names for the 5 native species of *Betula* with special reference to those given to *B. pubescens* and *B. verrucosa*, including their various bark and timber types. For the former species 'glasbjörk' is suitable; for the latter the choice lies between the two names 'masurbjörk' and 'vårtbjörk,' neither of which is free from objections.

156. CHATTERJEE, D. A review of Bignoniaceae of India and Burma. *Bull. bot. Soc. Bengal* 2 (1), 1948 (62-79). 14 refs. [R. Botanic Gardens, Kew.] O.B.D.

157. AUBRÉVILLE, A. Les *Dacryodes* (*Pachylobus*) et *Santiria* de l'ouest africain. [Species of *Dacryodes* (*Pachylobus*) and *Santiria* of West Africa.] *Bois For. Trop.* No. 8, 1948 (342-8). 13 refs. [F.]

List of vernacular names, botanical description and key. [Cf. *For. Abstr.* 11 (No. 327).]

158. SWAMY, B. G. L., and BAILEY, I. W. The morphology and relationships of *Cercidiphyllum*. *J. Arnold Arbor.* 30 (2), 1949 (187-210). 36 refs.

159. PERRY, L. M. *Plantae Papuanae Archboldianae*, XIX. *J. Arnold Arbor.* 30 (2), 1949 (139-65).

Covers the Cunoniaceae in the Arnold Arboretum, and includes accounts of new species of the following genera:—*Spiraeanthemum*, *Spiraeopsis*, *Schizomeria*, *Weinmannia* and *Pullea*.

160. SWAMY, B. G. L. On the systematic relationships of the family Degeneriaceae. *Abstr. in Amer. J. Bot.* 35 (10), 1948 (816). [Biological Laboratories, Harvard University, Cambridge, Mass.] O.B.D.
Cf. *For. Abstr.* 11 (No. 126).

161. MADALSKI, J. Z badań nad *Fagus sylvatica* L. i *Fagus moesiaca* (Maly, Domin) Czezcott. [Studies on *Fagus sylvatica* and *F. moesiaca*.] *Acta Societatis Botanicorum Poloniae* 18 (2), 1947 (129-54). 10 refs. [Pol.e.] C.G.B.

A study of the number of lateral nerves per leaf in 23,789 leaves of *F. sylvatica*, including material collected for the purpose in Poland and herbarium specimens from a number of countries, showed that the mode for this species is identical with that of *F. orientalis*, and hence that this character is useless for separating the two species. Further, both this character and others used by Czezcott, fail to distinguish her 'species' from *F. sylvatica*, and *F. moesiaca* must be reduced to a synonym of *F. sylvatica*. Determinations of fossil material of *F. sylvatica* and *F. orientalis* will need revision in the light of these findings. From author's summary.

162. GALLE, F. C., and NANK, E. E. Oak leaf patterns. *Amer. Nurseryman*. 89 (6), 1949 (11-3, 48-50).

Presents photos of 30 species of Oak for purposes of identification, with general notes on the species.

163. HERMANN, F. J. Studies in *Lonchocarpus* and related genera, IV: The *Lonchocarpus rugosus* complex and additional Middle American species. *J. Wash. Acad. Sci.* 38 (9), 1948 (310-2). [U.S. Department of Agriculture.] A.P.B.

Cf. *For. Abstr.* 10 (No. 1685).

164. KAUSEL, E. Notas mirtológicas. [Notes on the Myrtaceae.] *Lilloa* 13, 1947 (125-49). [Span.g.] A.P.B.

165. AUBRÉVILLE, A. Les *Fagara* de l'ouest africain. [The *Fagara* spp. of equatorial West Africa.] *Bois For. Trop.* No. 9, 1949 (19-24). [F.]

Notes on distribution and identification.

166. MEYER, T. Las Sapotáceas argentinas. [The Argentine Sapotaceae.] *Lilloa* 13, 1947 (97-124 + 2 photos). 30 refs. [Span.f.] A.P.B.

167. KOBUSKI, C. E. *Studies in the Theaceae. XVIII. The West Indian species of Laplacea.* *J. Arnold Arbor.* 30 (2), 1949 (166-86).

13. FOREST ZOOLOGY

See also *For. Abstr.* 11
(Nos. 125, 131, 691 *et seq.*).

168. PETERSON, A. *Larvae of insects: an introduction to nearctic species. Pt. 1. Lepidoptera and plant infesting Hymenoptera.* Published by the author, Ohio State University, Columbus, Ohio. 1948. pp. 315. Many refs. \$5.00 (32s. 6d.).

169. FRASER, M. G. *Notes upon the biology of certain species of exotic Cerambycidae (Col.) occasionally imported into Britain.* *Ent. mon. Mag.* 85 (1019), 1949 (97-9).

Placaederus viridipennis and *Cordylomera suturalis* in *Khaya* sp.; *Pachydissus hector* and *Coptops aedificator* in *Afzelia* sp.

170. SCHEDL, K. E. *Bestimmungs-tabellen der palaearktischen Borkenkäfer. Teil I: Die Gattung Crypturgus Er. Teil II: Die Gattung Blastophagus Eichh. [Keys to the palaearctic bark beetles. Pt. I: The genus Crypturgus. Pt. II: The genus Blastophagus.] Reprs. from Zbl. GesGeb. Ent.* 1 (1; 2), 1946. pp. 15; 9. [G.]

171. SCHEDL, K. E. *Bestimmungs-tabellen der palaearktischen Borkenkäfer. Teil III: Die Gattung Scolytus Geoffr. [Keys to the palaearctic bark beetles. Pt. III: The genus Scolytus.] Monogr. Zbl. GesGeb. Ent.* No. 1, 1948. pp. 67. 32 refs. [G.]

172. SCHEDL, K. E. *Nachtrag zur Gesamtliteratur der Borkenkäfer (Ipidae und Platypodidae) von R. Kleine 1939. [Supplement to 'The complete literature of the bark beetles' by R. Kleine, 1939.] Zbl. GesGeb. Ent.* 1 (1-6), 1946 (32; 63-4; 96; 123-8; 185-90). I.I.E.

Installments covering authors' names from A to Harutzawa.

173. FRANSEN, J. J. *Enige beschouwingen omtrent de kleurvariëteiten en aberraties van den dennenscheerder (Myelophilus piniperda L.) [Some observations on the colour varieties and aberrations of M. piniperda.]*

Entomologische Berichten, Amsterdam 12 (279), 1948 (213-6). 10 refs. [Du.e.] I.I.E.

174. KOEHLER, W. *Troilus luridus F. (Hem.-Het.). Rospr. Spraw. Inst. Bad. Leśn.* No. 51; 1948. pp. 80. 31 refs. [Pol.e.]

Troilus luridus differs from other Pentatomidae (subfamily Aspininae) by being essentially a forest bug, which settles on trees and only rarely on bushes and ground vegetation. Though it occurs throughout the Polish plain the author studied it in the Pine forests in the western parts of the country, where it is especially abundant in mixed stands with a shrub understorey. It has also been found on Willows and Alders bordering streams, preying on the larvae of *Agelastica alni*. The author notes that it kills its prey by stabbing and introducing poison. His observations have not confirmed the statement of Michalk [*Zeitschrift für wissenschaftliche Insektenbiologie* 26, 1931] that the liquid emitted by the bug while stabbing has the property of dissolving the integument of its victim. The author gives a list of insects on the larvae of which *Troilus luridus* preys, and an estimate of the number killed by one bug. Although the larvae of such dangerous forest pests as *Lymantria monacha*, *Panolis flammea* etc., are among its prey, the author believes that further study is needed before the text-book statement that *Troilus luridus* ranks among the chief predators of these pests can be accepted. The role of the bug as a protective agent is, on the other hand, undeniable, and the fact that it occurs mainly in mixed stands is one more argument against pure plantations.

The bulletin, which gives a full description of the morphology, biology and life cycle of *Troilus luridus*, is based on laboratory and field observations, contains original drawings, and a list of Polish and German literature.

175. KANGAS, E. *Biologische Beobachtungen und Züchtungsversuche an einigen Tenthrediniden (Hym.). [Biological observations on and experiments in rearing some Tenthredinidae (Hym.).] Annales entomologici fennici, Helsinki* 10 (3), 1944 (172-81). 3 refs. [G.] I.I.E.

Lygaonematus wesmaeli on Larch and *Abia lomiceræ* on *Lonicera xylosteum*.

176. HARRIS, W. V. *Some aspects of the termite problem.* *E. Afr. agric. J.* 14 (3),

1949 (151-5). 12 refs. [Department of Agriculture, Uganda.]

Reviews briefly the African species, discusses what little is known about their influence on soil and vegetation, and emphasizes the urgent need for teamwork in research.

177. FORD, L. T. **A guide to the smaller British Lepidoptera: the life histories and foods of upwards of 1370 species of our smaller moths with indices of the foods and of the insects with cross references.** South London Entomological and Natural History Society. 1949. pp. 230. Price 15s.

178. WELLINGTON, E. F. **Artificial medium for larval rearing.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 5 (1), 1949 (2).

An artificial medium for rearing Spruce budworm has been developed for work in the

Pathology Laboratory. The medium is prepared by combining a foliage-water suspension, mixed in a 'Waring blender', with hot agar and 'Mycoban'. The whole is poured into petri dishes to harden. The 'Mycoban' inhibits the growth of micro-organisms while apparently not affecting the growth and fecundity of the Spruce budworm. This insect has been reared through its whole feeding period on such a medium. Three other species of Lepidoptera with similar feeding habits have been successfully reared on appropriate foliage media. On the other hand, exposed feeders such as the sawflies and loopers, which feed clasping a needle or leaf with their thoracic legs, will not feed on the flat surface of the medium.

179. STEWART, R. E., and ALDRICH, J. W. **Breeding bird populations in the Spruce region of the Central Appalachians.** *Ecology* 30 (1), 1949 (75-82). 6 refs.

2. SILVICULTURE

See also *For. Abstr.* 11 (Nos. 101, 137).

180. La sylviculture au Maroc. [Forestry in Morocco.] *Rev. int. Bois* 16 (140; 141; 142), 1949 (41-3; 64-8; 87-8, 92). [F.]

181. LEBARRON, R. K. **Review of published literature on the [management of the] Larch-Douglas fir type [in Montana].** *Sta. Pap. Nth. Rocky Mt. For. Range Exp. Sta.* No. 15, 1948. pp. 14. 33 refs.

182. ŠIVIC, A. Cemprin ali limba. [*Pinus cembra*.] *Gozd. Vestn.* 5 (4/5), 1946 (85-96). 4 refs. [Sloven.]

A general account of this species, from German and Austrian sources—including range, salient botanical and silvicultural characteristics, management, and products. It is not found in the Slovene Alps except on moist ground above Primary rock formations.

183. LOUIS, J., and FOUARGE, J. **Essences forestières et bois du Congo.** Fascicule 6. *Macrolobium dewevrei*. [Forest tree species and timbers of the Congo. Fascicle 6. *Macrolobium dewevrei*.] Institut National pour l'Étude Agronomique du Congo Belge, Brussels. 1949. pp. 44 + plates. [F.]

A detailed study, including botanical description, habitat, ecology, phenology, distribution, vernacular names, silviculture, wood

characteristics and properties, uses, and susceptibility to borer attack; also a note on the genus as a whole, and a bibliography. [Cf. *For. Abstr.* 9 (No. 2232); 10 (No. 2608).]

184. FOWELLS, H. A. **Cork Oak planting tests in California.** *J. For.* 47 (5), 1949 (357-65).

Gives the results to date of experimental plantings of *Quercus suber* made in California in 1942 [cf. *For. Abstr.* 7 (No. 1358)]. It is concluded that, if Cork Oak is to be grown for commercial purposes, the planting site should be in the higher or wetter parts of the woodland vegetation types, on well drained soils, neither sandy nor too heavy. Spot sowing appears to be as effective as the planting of pot-grown trees. Weeding is necessary, and monthly watering desirable, during the first year; also protection against deer, cattle and gophers.

185. JOLLY, N. W. **The genus *Eucalyptus*—its past and its future in Pacific forests.** *N.Z. J. For.* 5 (5), 1948 (1949), (389-400).

Briefly describes silvicultural characters, forest types, and the management of Eucalypt forests and plantations.

186. SWITZER, H. D. **The management of Cottonwood in the bottomlands of**

southern Illinois. *Sth. Lumberm.* 177 (2225), 1948 (153-7). 3 refs.

Since Cottonwood (*Populus deltoides* var. *virginiana*) needs a great deal of light, prevailing cutting methods tend to produce poor regeneration, and usually the species needs some artificial aid to re-establish itself. Poor trees and undesirable competing species should be eliminated from the stand, and thinnings made, but no heavy cuttings until most trees in the stand are of 22-30 in. in diameter. The final cut should remove all tree growth in openings at least 75 ft. in diameter or in strips 100 ft. or more wide. The ground must be free of tree and brush growth if young Cottonwood is to regenerate. Fall, winter or early spring is best for logging. If no natural seeding can be expected, young trees must be planted before weed and brush cover get established. A moist but well drained sandy loam or silty soil is required. Lands protected from late spring and summer floods do not favour natural regeneration and need to be planted. Young stands need protection from fire and grazing.

187. WHITE, D. G. **Bamboo culture and utilization in Puerto Rico.** *Circular, Federal Experiment Station in Puerto Rico, Mayaguez* No. 29, 1948. pp. 34. 31 refs. Price 10 cents.

A report on experiments of the Federal Experiment Station in Puerto Rico in cultivating various species of *Bambusa*, *Sinocalamus* and *Dendrocalamus*. Instructions are given for propagation, planting and maintenance, with some observations on development—flowering and seeding, rate of growth, root system. Harvesting methods, curing, storage, insect diseases and utilization are also dealt with.

21. SILVICULTURE CHARACTERS OF TREE SPECIES

See also *For. Abstr.* 11
(Nos. 127, 313-5).

21.0. Adaptability to the General Environment. Acclimatization

See also *For. Abstr.* 11
(Nos. 71, 252, 267-8, 675, 811).

188. GUINIER, P. Les essences exotiques dans la forêt française. [**Exotic species in the French forest.**] *Bull. Com. For., Paris* 13 (81), 1948 (1025-41). [F.]

189. Principaux conifères acclimatés en France et pouvant présenter de l'intérêt au point de vue forestier. [**The principal conifers acclimatized in France and of possible forestry interest.**] *Bull. Com. For., Paris* 13 (81), 1948 (1083-90). [F.]

Brief notes on identification and provenance.

190. KINDT, S. **Japanerlærk.** [**Japanese Larch [in the Gissfeld forest district].**] *Dansk Skovforen. Tidsskr.* 33 (11), 1948 (495-519). [Dan.]

The oldest Japanese Larch plantations in Denmark date from about 50 years ago. The author describes experience of this species in the Gissfeld forest district, where it has been used since about 1900, mostly in various combinations with Beech. In the earlier trials it was used partly as a nurse to Beech and partly for filling gaps. It has proved a poor protection to Beech against frost, as it cannot be planted closely enough to afford protection without shading the Beech. It gives sufficient shade to effect natural pruning of the latter species. Growth data for various compartments, including one of pure Larch planted as 2/2 stock in 1930, are given in tables. Height and diameter growth are compared in curves with Japanese Larch at Sølstedgaard and quality II Beech (yield-table data). The Larch in the Gissfeld district keeps pace with the Beech for at least 60 years, and probably to the end of the 120-year rotation. Its height growth here, on poor soils, is superior to that on rich soil at Sølstedgaard. In mixture with Beech, however, it tends to have a strongly branched top and this would probably preclude its remaining for the whole of the rotation. Closer planting in pure plantations seems to be indicated, with very early and frequent thinnings. Pruning by knocking off dead branches with a stick has proved satisfactory. A rotation of 50-70 years should give heights of 23-27 m. and diameters of 35-70 cm. The rather poor form, which can be largely corrected by thinning, is believed to be a reaction to the Danish climate rather than a matter of provenance. Preliminary reports from buyers of the wood are favourable on the whole, though in small sizes converted timber is said to warp, and some samples for ships' masts were too knotty at the top. In the Gissfeld area no special trouble has been experienced from diseases or pests. Some mouse damage to leaders has been tackled

by binding the top lateral shoot to the damaged terminal. Attack by *Fomes annosus* has been infrequent. *Hylobius abietis* may be troublesome in districts where it is plentiful.

191. CEDAR [*Juniperus virginiana*] and Pine [*Pinus echinata*, *P. ponderosa*, *P. nigra* var. *austriaca*, *P. sylvestris*, *P. densiflora*, *P. thunbergii*] as farm trees for Oklahoma. Bull. Okla. agric. Exp. Sta. No. B-331, 1949. pp. 18. 5 photos.

192. SMITH, C. M. **Acclimatisation versus domestication of forest species: the problem of South Pacific forestry.** N.Z. J. For. 5 (5), 1948 (1949), (374-88). 21 refs. [Paper read at the 7th Pacific Science Congress, Auckland, Feb. 1949.]

The author first discusses general principles of acclimatization and domestication, examines the endemic genera of the south Pacific (e.g. *Eucalyptus*, *Araucaria*, *Nothofagus*) and concludes that *Nothofagus* species have most of the qualities desirable in a species to be domesticated, i.e. frugality, gregariousness, good seed production (though coppicing and vegetative propagation are apparently not possible), readiness to transplant, and monoecism. [Cf. For. Abstr. 11 (Nos. 144, 203).]

21.1. Light and Temperature Requirements

193. BAKER, F. S. **A revised tolerance table.** J. For. 47 (3), 1949 (179-81). 4 refs.

Revision of a table prepared in 1911 by Zon and Graves showing shade tolerance of the most important U.S. tree species. The revision is based on answers to a questionnaire.

194. WAREING, P. F. **Photoperiodic control of leaf growth and cambial activity in *Pinus sylvestris*.** Nature, Lond. 163 (4150), 1949 (770-1). 8 refs.

Experiments with different photoperiods showed that short photoperiods (10 hr.) induce earlier cessation of growth of the shoot in first-year seedlings of *Pinus sylvestris* than long photoperiods (15 hr.) so that fewer leaves are formed before the formation of a terminal resting bud. There is also a reduction in the length of the internodes, leading to a rosette type of growth, and this occurs also in older plants. Under a 10-hr. photoperiod, needles cease to grow in length 6-8 weeks earlier than under natural conditions. It seems probable

that cessation of needle growth in the autumn is controlled by the reduced day length at that season.

Day length was also found to affect the duration of cambial activity. Two series of 2-year-old seedlings of *Pinus sylvestris* were kept under (a) natural and (b) 15-hr. photoperiods respectively, from the end of August (when leaf growth had ceased), the longer photoperiod being obtained by giving supplementary low-intensity (20-25 foot-candles) illumination to extend the natural photoperiod. Examination of the two series at the end of October showed that in series (a) the cambium was dormant or showed only slight growth, whereas in the majority of plants in series (b) the cambium was still very active. Confirmation of these results was obtained in other experiments in which constant photoperiods of 10 and 15 hr. respectively were used. In poor specimens the cambium was dormant irrespective of the day-length treatment, and it would appear that nutrition also affects the duration of cambial activity. The inhibition of cambial activity by short days is effective only at the end of the growing season, for 2-year-old plants grown under a 10-hr. photoperiod in the spring, showed definite (though reduced) secondary growth, at least until the cessation of leaf growth.

It seems possible that these photoperiodic effects in woody species result from the action of light on the production or availability of auxin within the plant, and that quite low light intensities are effective.

195. CAPPELLETTI, C. **La luce e la persistenza delle foglie sul ramo.** [The effect of [continuous] light on the persistence of leaves on the branch.] Nuovo G. bot. ital. (n.s.) 53 (1/2), 1946 (365-8). 4 refs. [It.] O.B.D.

Observation of Plane trees [*Platanus orientalis*] subject to nocturnal illumination from street lamps at Rome, showed that such trees retained their leaves in a fresh, green condition after neighbouring trees had lost theirs [cf. For. Abstr. 9 (No. 825)]. Similar conditions at Turin, however, had no apparent effect. It is suggested that the Plane has a tendency towards the evergreen habit in low latitudes and the additional light was sufficient to stimulate this tendency at Rome, but not at Turin, where the climate is much more rigorous and the night

temperature, in particular, notably lower than that of Rome.

21.3. Soil Requirements

196. PURI, G. S. **The secular or pre-historical factor and its application to forest ecology and silviculture.** *Indian For. Ranger Coll. Ann.* 1948 (71-5). 24 refs.

The author adduces prehistoric data (fossil flora etc.) to explain the ecology of *Cedrus deodara* with particular reference to Kashmir. It seems likely that plantations of this species will do better, and natural regeneration be more successful, where the clay capping the rocky substratum is thin. The best soils for this species are those from which the clay has been completely removed.

197. MATYUK, I. S. **Vliyanie pochvennykh uslovii na rost sosnovykh kul'tur. [Influence of soil factors on the growth of Pine plantations.]** *Pedology* 1949 (1), (49-53). 4 refs. [Russ.] A.C.P.

(1) In the Chir sands [cf. *For. Abstr.* 9 (No. 860), where for Mamyuk read Matyuk], *Pinus sylvestris* has grown quite satisfactorily (quality class II) up to 16 years of age on immature soils (wind-blown sands) where:—(a) the top layer is sandy loam with a humus content of 0.74% and a clay-loam bed 100 cm. thick exists at 40 cm. depth; (b) the top 80 cm. is sand drift overlying a sandy soil coloured with humus (humus content 0.76%), resting on an 80-cm. bed of sandy loam at 145 cm. depth. (2) Growth to the same age was poorer (quality class III) where beds of clayey and sandy loam are absent down to 270-305 cm., no buried soils are present, and the humus content of the sand is only 0.32-0.57%. (3) These differences are correlated with the mechanical composition of the immature soils. The best growth occurred where the top horizon contained fewer clay particles than underlying layers 40-145 cm. deep, since under these conditions moisture is held at this depth, which coincides with the main rooting zone of the Pine.

21.6. Behaviour in the Stand. Growth Form. Habit. Tree Classes

See also *For. Abstr.* 11
(Nos. 276, 759, 769).

198. MUNGER, T. T. **A tree classification for Douglas Fir.** *Timberman* 50 (5), 1949 (76, 79).

Gives brief details of a tentative tree classification scheme for Douglas Fir, prepared by a subcommittee of the West Coast Forestry Procedures Committee. Five characteristics are recognized, i.e. crown class, thrift, physical defects, surface clear and decay, and a symbol is given for each.

199. ROE, A. L. **A preliminary classification of tree vigor for Western Larch and Douglas-Fir trees in Western Montana.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta.* No. 66, 1948. pp. 6.

21.8. Phenology

See also *For. Abstr.* 11 (Nos. 194-5, 322).

200. GIANNUOLI, S. **Ciclo di accrescimento e differenziazione delle gemme in piante perenni nel territorio di Bari.** 1. Osservazioni su *Ficus carica* L. nell'anno 1946. 2. Osservazioni su *Prunus amygdalus* Stokes nel 1946. [Growth cycle and bud differentiation in perennial plants in the neighbourhood of Bari. 1. Observations on *Ficus carica* in 1946. 2. Observations on *Prunus amygdalus* in 1946.] *Nuovo G. bot. ital. (n.s.)* 54 (3/4), 1947 (432-83 + 27 photos). 21 refs. [It. it.] O.B.D.

201. PAOLIS, D. DE. **Ciclo di accrescimento e differenziazione delle gemme in piante perenni nel territorio di Bari.** 3. L'evoluzione della cerchia legnosa in *Prunus amygdalus* Stokes dal Dicembre 1946 al Dicembre 1947. [Growth cycle and bud differentiation in perennial plants in the neighbourhood of Bari. 3. Development of the annual ring in *Prunus amygdalus* Dec. 1946-Dec. 1947.] *Nuovo G. bot. ital. (n.s.)* 55 (2), 1948 (214-34). 3 refs. [It. it.] O.B.D.

In the trunk and young branches with a predominance of vegetative buds, differentiation of the annual ring begins in March, but in branches with a predominance of flower buds it begins in November-December. Early wood is differentiated March-May, and intermediate wood May-October. *From author's summary.*

202. MESSERI, A. **Osservazioni sull'influenza della siccità degli anni 1945-46 sulla differenziazione del legno secondario in rami di alcune essenze decidue e sempreverdi. [The influence of the drought of the years 1945-6 on the differentiation of secondary wood in the branches of some deciduous and**

evergreen species.] *Nuovo G. bot. ital. (n.s.)* 53 (1/2), 1946 (353-5). [It.] O.B.D.

Cupressus sempervirens, *Fraxinus ornus*, *Juglans regia*, *Ulmus campestris*.

203. POOLE, A. L. **The flowering of Beech.** *N.Z. J. For.* 5 (5), 1948 (1949), (422-7). 9 refs.

A record, based on the observations and collections of many people, of the heavy flowering of *Nothofagus* spp. in N. Zealand in the spring of 1948. A preliminary attempt is made to correlate this and previous heavy flowerings with preceding hot summers. Comparisons are drawn with the flowering and seeding behaviour of *Fagus sylvatica*. From author's summary. [Cf. *For. Abstr.* 11 (No. 192).]

204. BURGOS, J. C. Notas ecológicas sobre nogal criollo (*Juglans australis* Gris.) cultivado en La Plata. [Ecological notes on *J. australis* cultivated in La Plata.] *Darwiniana*, B. Aires 8 (2/3), 1948 (406-9). 4 refs. [Span.] O.B.D.

Brief notes on the phenological cycle and natural regeneration of two trees of *Juglans australis*, in the arboretum of the Facultad de Agronomía in La Plata.

205. [Effect of gregarious flowering of Bamboo on forest regeneration.] *Rep. For. Res. C. P. & Berar* 1947, 1948 (18).

Gregarious flowering and dying back of Bamboo [*Dendrocalamus strictus*] clumps a few years ago, helped to increase the reproduction of tree species, such as Teak, *Bombax malabaricum*, *Dalbergia latifolia*, *Xylia xylocarpa* and *Pterocarpus marsupium*, but the suppressing effect of dense Bamboo regeneration is now being felt increasingly, particularly in areas worked heavily in recent years, and much of the reproduction of tree species is likely to be suppressed.

21.9. Longevity

See *For. Abstr.* 11 (No. 55).

22. SILVICULTURAL SYSTEMS.

FORMS OF STAND

22.1. High Forest Forms

See also *For. Abstr.* 11 (Nos. 383, 719).

206. ROE, A. L. **Thirty-nine years' growth in a cut-over Larch stand.** *Res.*

Note Nth. Rocky Mt. For. Range Exp. Sta. No. 70, 1948. pp. 6.

A long-term study of the effect of selective logging of virgin stands of Larch (*Larix occidentalis*) in Western Montana showed that the removal of the larger and more vigorous Larch favoured ingrowth of Douglas Fir and several species of true Fir. The high proportion of Larch found in virgin stands is largely the result of past fires, and in the absence of fire the natural tendency is for more shade-tolerant species to increase and Larch to decrease in abundance. Experiments are being made in methods of reversing this successional trend.

207. GRUSCHOW, G. F. **First cutting cycle completed on the Olustee experimental forest.** *Sth. Lumberm.* 177 (2225), 1948 (139-40). [Southeastern Forest Experiment Station.]

The Olustee (Florida) Pine forest-management experiment was started in 1942 with the object of determining:—(1) returns from different silvicultural management systems, (2) the economics of producing different products and combinations thereof, (3) returns from highly intensive, compared with moderately intensive management, and (4) suitability of various methods of converting from unmanaged to managed forest stands. Thirty-six compartments of about 40 acres each were formed, some being managed on the uniform system and some on the group selection system. Three types of product were envisaged, sawlogs, resin and pulpwood. Twelve compartments, i.e. 2 for each end product, making 6 under each system, were allotted for high-intensity management (cutting cycle 5 years plus restocking, pruning and unrenumerative thinnings), and 24 for moderate intensity (10-year cycle for pulpwood and resin stands, 15 years for sawlogs). Yields from the first 5-year cutting cycle are tabulated. An outstanding feature is that in the process of converting from unmanaged to managed forest, a stumpage return of \$2.87 per acre per year was realized, although no main fellings were done.

208. WEDDELL, D. J. **Silvicultural practices in the Pine-hardwood types of the Piedmont.** *Sth. Lumberm.* 178 (2230), 1949 (40, 42).

The seed-tree method, or clear felling and planting, are recommended for this region,

where selection fellings encourage replacement of the Pine by hardwoods.

209. REYNOLDS, R. R. **Ten years of selective timber management.** *Sth. Lumberm.* 177 (2225), 1948 (121-4). [Southern Forest Experiment Station.]

Presents some results from 10 years' management of second-growth Shortleaf/Loblolly Pine/hardwood under the selection system at the Crossett Experimental Forest, Arkansas. About 1,000 acres were divided into 40-acre compartments. Eight of these were cut on a 9-year cycle, 8 on a 6-year cycle and 8 on a 3-year cycle. Inventories were made at the beginning of each study and before each cut. Nearly all the stands were originally badly understocked, but had a good distribution of size classes. The study was intended to demonstrate that a reasonable volume of products could be cut while the stands were being built up. In fully stocked stands (10,000 bd. ft. per acre at the end of the cutting cycle) a volume equal to total growth over the cutting cycle was taken at each cut. In stands with 2,000 to 10,000 bd. ft. per acre the amount of cut varied between half and all the growth, according to the stocking. In 10 years (1937-46) an average of 1,755 bd. ft. of Pine logs per acre was cut from the 1,000 acres. Nevertheless, the average volume per acre in trees of 12 in. d.b.h. and above, increased from 4,807 bd. ft. in 1937 to 6,253 bd. ft. in 1946. During this period the average log cut scaled 109 bd. ft., yet a table of flexible minimum diameter limits for compartments cut more than once, demonstrates that the diameter limit has remained constant for 7 out of 15 compartments, has decreased slightly in 5 and increased a little in 3. For all practical purposes, therefore, the diameter limit has remained constant. A stand table for compartments cut on the 3- and 6-year cycles shows that the number of sawlog trees and the size of the average tree have actually increased over the 10-year period. Elimination of low-grade hardwoods, a good Pine seed year and fire protection have also ensured Pine reproduction over most of the forest and hence the maintenance of sawlog yields.

210. BULL, H., WILLIAMS, E. B., and JUDSON, G. M. **Harvest-cutting studies in east Texas Loblolly and Shortleaf Pine.** *Sth. Lumberm.* 177 (2225), 1948 (282, 284-6, 288).

A progress report on a study of the effects of various silvicultural practices on mixed, unmanaged Loblolly [*Pinus taeda*] and Shortleaf Pine [*P. echinata*]. The study was begun in 1938 by the Southern Forest Experiment Station in the San Jacinto Experimental Forest. The stand was about 45 years old. Two management objectives were envisaged:—(1) pulpwood alone, with, possibly, small sawlogs from trees not more than 14 in. in d.b.h., and (2) sawlogs from high-quality trees, averaging at least 18 in. in d.b.h., with pulpwood only from thinnings and tops. Under (1) the following practices are being followed:—(a) selection felling, 10-year cycle, (b) felling to create or maintain an even-aged stand, (c) heaviest felling permitted under the rules adopted by an association of Louisiana, Arkansas and Texas pulp mills in 1937, (d) clear felling. Under (2) the following practices are followed:—(e) selection felling, 5-year cycle, (f) selection felling, 10-year cycle, (g) selection felling, 15-year cycle, (h) shelterwood felling. Some preliminary statistics are given of the 10 years' working and the following observations made:—(i) average annual net growth per acre on good sites was highest in the even-aged pulpwood plots; (ii) average annual net growth % in cu. ft. was highest on the Pulpwood Association plots (c), and in bd. ft. on the even-aged pulpwood plots (b); (iii) net growth per acre in both cu. ft. and bd. ft. has increased during the second 5-year period except in the 5-year selection plots (e); in the shelterwood plots there has been a decrease in net bd. ft. growth only; (iv) recent abnormally high mortality, due primarily to ice and beetles, was nearly three times more severe in Shortleaf than in Loblolly. On good sites regeneration is generally satisfactory in the heavily cut areas; elsewhere it is too early to say.

211. PEARSON, G. A. **Management of cut-over land in the interior Ponderosa Pine type.** *J. For.* 47 (3), 1949 (172-8). 9 refs.

Under the modified practice of the past decade, selective logging in Ponderosa Pine stands of the western U.S.A. (still confined mainly to virgin stands) has been based on the marking only of overmature and deteriorating trees, leaving all sound mature or intermediate trees. Capacity for increment has been estimated in volume per tree rather than per acre,

without reference to lumber grades, even to the extent of deliberately favouring wolf trees at the expense of supposedly less vigorous trees of better form. The possibility of transferring increment from inferior to superior stems by careful marking, leaving as many small, well distributed trees as possible, is illustrated from an experiment on 480 acres in Arizona. [Cf. *For. Abstr.* 8 (No. 1018).]

212. KRAUCH, H. **Growth after cutting in an even-aged mature Ponderosa Pine stand.** *J. For.* 47 (4), 1949 (296-9).

213. KRAUCH, H. **Managing Ponderosa Pine for hewn cross ties.** *J. For.* 47 (5), 1949 (371-4).

Data derived from the records of 30 years of selective cutting for railway sleepers in Ponderosa Pine stands in New Mexico, show that though management for a single product is possible, fuller utilization offers greater advantages.

214. KRAUCH, H. **Silvicultural treatment of virgin Douglas-Fir stands in the southwest.** *J. For.* 47 (3), 1949 (200-3).

215. AUFDERHEIDE, R. **Getting forestry into the logging plan.** *Timberman* 50 (5), 1949 (53-6, 96).

Where clear-felling in the Douglas Fir region is considered necessary, a 'staggered setting' system, whereby openings not larger than 80 acres are cleared, offers definite advantages in fire protection and natural regeneration where topography permits. Partial cutting in thrifty, mature stands about 150 years old brings an excellent return in quality increment, defective and low-producing elements being salvaged in a series of light improvement fellings. Such stands can be managed on a rotation of about 200 years. The two systems may be combined with advantage. Some practical advice is given on road-building, logging methods and avoidance of windfall. A plan for a combined forestry logging operation on those lines in the Siuslaw National Forest is included and discussed.

216. [Tropical shelterwood system in Benin Division.] *Rep. For. Adm. Nigeria* 1947-8, 1949 (19).

Comparison of a second seedling count with a count made after the first climber cutting, showed increases of over 100% for all species

and very much more for *Lovoa*, *Azelia bipindensis*, and *Piptadenia*. The greatest increase recorded was 750% for *Lovoa* after 2 years' treatment. Observation, by planting stakes against seedlings as an indicator, has shown that 4-ft.-high *Lovoa* and *Entandrophragma* will double their height in a year under full top light. The desirability, once the seedlings are fully established, of a much more rapid admission of top light than was originally provided for under this shelterwood system, must clearly be investigated, but the controlling effect of shade on weed growth cannot be disregarded.

22.2. Coppice Forest

217. MAKINS, F. K. **Hazel underwood in the South of England.** *Quart. J. For.* 43 (2), 1949 (66-71). 10 refs.

A review of the ecology, management and exploitation of Hazel coppice under Oak standards. [Cf. *For. Abstr.* 7 (No. 177).]

218. BOUDRU, M. À propos des taillis sous futaie. [Coppice with standards.] *Ann. Gembl.* 55 (1), 1949 (28-35). 16 refs. [F.] A.P.B.

Problems connected with the present state of coppice with standards in Belgium are discussed. The tendency of the last 50 years to increase the number of standards reserved (mainly Oak) has upset the equilibrium formerly maintained in such forests and caused a tendency for the forests to revert to a type closer to their normal, primitive form. A falling-off in the regeneration of Oak is an important symptom of this reversion. The author suggests that regeneration of Oak might be encouraged by a clearance of undergrowth in spaces devoid of standards, with fairly frequent cuttings of the coppice elsewhere; a good rate of increment could also be maintained among the standards by managing them on a kind of group selection system.

219. GIORDANO, G. Dei cedui di ontano e di robinia della pianura piemontese. [Alder and Robinia coppice of the plain of Piedmont.] *Ital. for. mont.* 4 (1), 1949 (25-34). [It.]

Notes on methods of establishment of coppice plantations of *Alnus glutinosa* and *Robinia pseudoacacia*, followed by volume tables and tables of increment and yield by 'vigour' [height/age] classes for each species, the data

being set out in both tables and graphs. Alder (both natural and artificial stands) is managed as coppice, usually on a rotation of 10 years, but sometimes of only 5-7 years where neighbouring vineyards need large quantities of small poles. Stools are spaced 1.8-2.5 m. apart in rows 4-6 m. apart, giving 800-1,200 per ha. The number of stems per stool which develop normally seldom exceeds 5 or 6, the average number being 4.

The Robinia coppice is mostly of natural occurrence and density varies from 800 to 2,000 stools per ha. The number of shoots is small, often only one to each stool, but there is profuse suckering which provides new stools as required. Rotations vary from 7 to 12 years. No attention is required between fellings. Robinia is mainly used for firewood, but the better stems can be used as posts and scaffolding and for wheelwrighting and tool handles.

22.6. *Changes of Silvicultural System*

See also *For. Abstr.* 11 (No. 303).

220. Pour la conversion de la forêt gabonaise en forêt pure d'Okoumé. [A proposal for the conversion of the forests of Gabon into pure *Aucoumea klaineana* forest.] *Bois For. Trop.* No. 9, 1949 (97-100). [F.]

The French colonial commission is at present examining a proposal put forward by a Councillor of the Republic, urging on the government a programme for the conversion of the mixed forest of Gabon into pure *Aucoumea klaineana* forest. The present memorandum summarizes the conclusions reached as a result of research and experiments by the Forest Department in Gabon, on the regeneration of this species, which is a strong light-demander and regenerates naturally on cut-over land or abandoned fields. It is believed that the process of conversion could be carried out in a period of 100 years.

221. MINCKLER, L. S., FASSNACHT, D. L., and TRAIN, R. K. Growth and species evaluation of some unmanaged upland hardwoods in Southern Illinois. *Tech. Pap. Cent. St. For. Exp. Sta.* No. 110, 1948. pp. 9.

Describes the present condition of these stands and makes some recommendations for converting an unmanaged to a managed forest.

222. A Sugar Pine regeneration cutting experiment. *W. Cst. Lumberm.* 76 (3), 1949 (62, 64).

Experiments by the California Forest and Range Experiment Station in the improvement and regeneration of a virgin tract of Sugar Pine [*Pinus lambertiana*] in the Stanislaus National Forest, California. The management plan, based on a condition class inventory to determine the areas requiring improvement and (group) regeneration fellings, fixes the conversion rotation at 80-100 years, for an average tree of 22-24 in. d.b.h. Only 20% of the area, it is estimated, can be maintained with Sugar Pine; most will go to White Fir [*Abies concolor*]. Some details of the survey and initial felling operations are given.

23. FORMATION OF STANDS

23.1. *Natural Regeneration*

See also *For. Abstr.* 11

(Nos. 205, 216, 218, 231-2, 275, 714).

223. HOLT, L. Restocking of Spruce. Practical departures from our present cutting methods, when required. *Woodl. Res. Index Canad. Pulp Pap. Ass.* No. 53 (F-2), 1949. pp. 15. 81 refs.

Black, White, and Red Spruce are dealt with in this paper. Of the three, White Spruce is the one that presents the greatest regeneration difficulty. The literature on Spruce regeneration is reviewed. The author concludes that, in Eastern Canadian conditions, pure Spruce is not a stable climax, but will in the natural course of things be succeeded by Balsam Fir. Under normal conditions, only a forest fire will again bring in pure Spruce stands. Present cutting practices in pulpwood forests are working against Spruce reproduction. To obtain Spruce regeneration, as fire is not yet a silvicultural tool in Canada, some form of mechanical soil disturbance is probably necessary.

224. PHELPS, V. H. Scarification to induce White Spruce regeneration. *Silv. Leaflet. For. Serv. Can.* No. 29, 1949. pp. 2.

Scarification of sample plots in typical Spruce/Poplar forest on Riding Mt., by a tractor-drawn Athens disk-type plough, resulted in an average of 43% of plots with seedlings and a catch of 3,124 seedlings per acre

compared with 14% and 569 on controls. Competition from herbaceous vegetation did not appear to be a serious factor at the end of the first growing season after scarification.

225. CLARK, H. D. JR. **The effect of ground cover on germination and establishment of Loblolly and Shortleaf Pines.** *Abstr. of thesis, in J. For.* 47 (5), 1949 (377). [Louisiana State University.]

Results of this work indicate that exposed mineral soil is the best seedbed, but that lack of moisture can offset any advantage gained by seedbed conditions.

226. POMEROY, K. B., and TROUSDELL, K. B. **The importance of seed-bed preparation in Loblolly Pine management.** *Sth. Lumberm.* 177 (2225), 1948 (143-4).

In order to study the influence of seedbed preparation on the germination and growth of Loblolly Pine [*Pinus taeda*] a survey was made in 1947 of 2 compartments, which had been tractor logged in 1946 under the clear-strip system, and one of which had been burned. The greatest number and growth of seedlings were found on surfaces where mineral soil had been exposed by burning or by mechanical disturbance of the duff. Slash-covered and undisturbed duff surfaces were poor seedbeds. Logging followed by prescribed burning had created good seedbed conditions on 81% of the surface. Experiments in scarifying the ground before logging are now being made.

227. BICKFORD, C. A., and BRUCE, D. **Fire and Longleaf Pine reproduction.** *Sth. Lumberm.* 177 (2225), 1948 (133-5).

In order to study the effect of different seedbeds on the natural regeneration of Longleaf Pine [*Pinus palustris*], an area on the Dry Prong Tract in Central Louisiana was fenced and protected from fire at the time of the 1935 seedfall. When the seedlings were a year old various kinds of controlled burning were tried. Fresh burns and one-year roughs [land burned and left fallow for a year] had much the highest survival of first-year seedlings. Burning once or twice after the seedlings were a year old gave a better 6-year-old survival than no burning or annual burning.

228. [Natural regeneration of Teak.] *Rep. Wkg. Plans Silv. Ent. For. Dep. Burma 1945-6, 1949 (39).*

Endeavours were being made before the war in the Shan States, to induce natural regeneration of Teak by making clearings under seed-bearers. In one instance a clearing of several acres had been made where all large trees other than Teak were removed by poisoning with sodium-arsenite solution. The ground, in 1946, was covered with a dense growth of *Eupatorium odoratum* 6-8 ft. high, through which the tops of Teak saplings in considerable quantities were apparent. It is thought that Teak regeneration in adequate quantity will make its way through the weed growth, which will afford it some degree of protection against wild elephants. These seem to be irresistibly attracted to man-made clearings and to sapling growth of Teak, which they damage to a remarkable degree. A little of the bark is eaten, but for the most part the trees are wantonly broken and trampled down. In the past, weedings intended to benefit young Teak have almost invariably been followed by its being ruined by elephants.

23.2. Artificial Regeneration

See also *For. Abstr.* 11 (Nos. 101, 219).

229. HAHR, G. **Sådd eller plantering av tallskog? [Sowing vs. planting of Scots Pine.]** *Skogen* 35 (20), 1948 (232-3). 1 ref. [Sw.]

Gives data obtained in 1948, at the time of the first thinning, for two plots in *Pinus sylvestris*—(a) sown, 29 years old; (b) planted, 28 years old. These are on uniform soil, have been uniformly treated, and (though no precise record of origin exists) show no reason for supposing any difference of provenance. Plot (a) was probably sown in spots spaced 1.5 × 1.5 m., and (b) planted at the same spacing. The chief data (those for (b) in parenthesis) are:—*Residual stand after thinning:* 154.5 (173.1) cu.m./ha., with 3,880 (2,470) trees/ha. of mean d.b.h. 8.92 (12.25) cm. and mean height 10.5 (11.5) m. *Thinning:* 63.7 (54.0) cu.m./ha., consisting of 5,880 (1,090) stems of mean d.b.h. 5.0 (10.4) cm., mean height 8.2 (10.4) m., and stumpage value Kr. 1,034 (1,222). It is estimated that even the first thinning must have repaid the extra cost of planting. [Cf. *For. Abstr.* 10 (No. 1484).]

230. [Methods of planting *Xylia dolabiformis*.] *Rep. Wkg. Plans Silv. Ent. For. Dep. Burma 1940-1, 1949 (61-2).*

An experiment was started to test the comparative rate of growth of *Xylia dolabriformis* from (a) seeds sown at stake (the usual method), (b) one-year-old transplants, (c) stumps, and (d) cuttings. Results at the end of the first year were as follows:—

	Percentage survival	Average height (inches)
Seed	89.6	9.6
One-year transplants	94.5	13.6
Stumps	85.4	7.9
Cuttings	A failure: only 5 sprouted out of 144.	

It appears from this that the extra trouble and expense of obtaining transplants or stumps is not compensated for by strikingly superior survival or growth.

23.22. Preparatory Work. Auxiliary Measures

See also *For. Abstr.* 11
(Nos. 289, 292, 796).

231. BJÖRKHEM, K. E. Ny markberedningsapparat. [A new implement for soil scarification.] *Skogen* 36 (5/6), 1949 (66). [Sw.]

This implement, invented by H. Andersson, consists of a simple metal frame carrying two stout claws, which are specially sprung so that they disengage on meeting major obstacles (e.g. large stones), and handles for the operator. The frame is horizontally hinged to the rear of a tractor, with springs which keep it tilted upwards unless the operator, walking behind the tractor, presses it down into action. This arrangement relieves the operator of much unnecessary exertion and leaves him free to choose the intervals at which patches should be scarified according to the nature of the ground. Trials have been promising and the implement has often made as many as 1,200–1,500 seed patches per effective working hour. It can be used on light caterpillar tractors such as those now in common use in Norrland for both agriculture and forest work and is figured on a Cletrac HG.

232. CALLIN, G. Bergs skogsmarkskultivatorer. [Berg's forest cultivators.] *Skogen* 36 (5/6), 1949 (67). [Sw.]

(1) An improved horse-drawn scarifier, the chief features of which are that the wheels and the scarifying device are mounted on independent axles, thus permitting better work on irregular ground, and that the claws of the scarifying device can be released by the driver (who has little else to do) when obstacles are met with. On a burnt mor in Norrland this machine made 2,900 patches, averaging 0.28 sq. m. in size, in 3.38 hours. The patches made need some hand trimming, which takes about 2 hours/ha., and the total time for soil scarification amounts to almost 2 man-days/ha.

(2) A tractor-drawn scarifier which proved too lightly constructed and is being rebuilt in a heavier model. In the preliminary trials the first model, drawn by a 1½-ton Cletrac HG, dealt with 1.1 ha. of very grassy but relatively stone-free land in 2.2 hr., making 3,550 seed patches averaging 0.18 sq. m. in area. As with (1), the patches needed tidying up by hand.

233. TALUKDAR, H. P. Taungya system in West Bengal. *Indian For. Ranger Coll. Ann.* 1948 (78–80). 3 refs.

A comparison of methods in West Bengal and Saharanpur, U.P.

234. [Trial of species and methods for old-field taungya.] *Rep. For. Res. C.P. & Berar* 1947, 1948 (24–5, 32–5).

Results are given of tests of a number of species considered suitable for planting by taungya methods in Hoshangabad. The data recorded are seed weight, germination %, optimum date of sowing, height growth and survival, effect of soil working and/or weeding, on height growth. So far, *Cassia siamea* shows the best results; but *Pongamia glabra*, *Ailanthus excelsa* and *Acacia catechu* are also promising. *Madhuca latifolia* may also turn out a useful tree, but it is very slow growing. Soil cultivation effected no significant difference in height growth, but a clear improvement in health and vigour.

23.23. Seed and Sowings

See also *For. Abstr.* 11 (Nos. 230, 730).

23.23.1. Seed Procurement, Treatment, and Testing

235. MARRERO, J. Tree seed data from Puerto Rico. *Carib. For.* 10 (1), 1949 (11–35).

6 refs. [E.Span.f.] [Tropical Forest Experiment Station, Río Piedras, Puerto Rico.]

Tabulated information summarizing over 25 years' work on forest tree seeds, and showing:— (1) number of seeds per lb. and germinative capacity, (2) extraction factors (i.e. seed weight in terms of fruit weight) and green moisture content, (3) results of storage tests not already published [cf. *For. Abstr.* 4 (164); 5 (110)], (4) lapse of time between sowing and germination, and (5) miscellaneous notes on various species.

236. [Seed production by *Pinus radiata* and seed extraction from its cones.] *Rep. For. Timb. Bur. Aust.* 1947, 1948 (14-5).

Investigations in 20- and 30-year-old unthinned *Pinus radiata* plantations gave the figures of viable seed fallen per acre during the year as 20,000 and 1,000 respectively. It is believed that the former figure would be sufficient to provide for satisfactory natural regeneration, but that seed from the old stands would be insufficient. Similar investigations are planned for thinned plantations.

Preliminary work indicates that the yield of seed from cones which have been put through an extractor may be considerably increased by soaking the cones in water and then putting them through the extractor again.

237. DELEVOY, G. À propos de sécheries de cônes. [Kilns for extracting seed from cones.] *Bull. Soc. for. Belg.* 56 (3), 1949 (89-117). 46 refs. [F.]

This article, written in 1940, is published as then completed, with no attempt to bring the literature references up to date. After a general review of methods of extracting conifer seed, the author gives a detailed account of the construction and operation of the automatic seed-extracting kiln at Groenendaal.

238. BERGH, T. K. A method of seed cleaning. *Amer. Nurseryman*. 89 (8), 1949 (7-8).

Maceration of pulpy fruit and removal of seed is successfully carried out at the Soil Conservation Service nursery at Winona, Minn., in a hammermill [cf. *For. Abstr.* 10 (No. 2554)]. The machine used is a Fairbanks-Morse, model 28T, mill having solid hammers. The bottom half is fitted with a heavy screen that can be removed and replaced by screens

having various-sized holes. A charge of $\frac{1}{2}$ to 1 bushel of fruit is put in the mill, which is then turned at a slow speed of 350-400 rev./min. A copious flow of water is hosed into it as it turns. As soon as the fluid that runs out of the bottom appears clear (in 5-10 minutes) the machine is stopped and the charge removed, spread on screen racks to dry, and then run through a fanning mill to remove debris and light seeds.

239. PRASAD, J. Storage of seed. *Indian For. Ranger Coll. Ann.* 1948 (58-65). 16 refs.

Includes lists of Indian tree species of which the seeds:—(1) cannot be stored, (2) exhibit dormancy, (3) retain viability very well, (4) retain viability moderately well.

240. PORTER, R. H. Recent developments in seed technology. *Bot. Rev.* 15 (4-5), 1949 (221-344). 502 refs.

A review, with some mention of forest species under treatment for impermeability and dormancy, storage and methods of assessing viability.

241. KRIER, J. P. Effects of treatments to induce germination of seeds of several species valuable for soil conservation plantings. *Abstr. of thesis, in J. For.* 47 (4), 1949 (312).

Reports attempts to break dormancy in *Juniperus occidentalis*, *J. scopulorum*, *Prunus emarginata*, *Rhamnus purshiana*, *Sorbus sitchensis* and *Symphoricarpos racemosus*.

242. YAMAGUCHI, S. Physiological studies on the germination of Yezo Spruce seed. *Journal of the Faculty of Agriculture, Hokkaido Imperial University* 48 (1), 1942. pp. 148. 148 refs. [E.c.]

Research on the germination of seeds of *Picea glehnii* and *Picea jezoensis*, factors studied including absorption of water and non-electrolytes, swelling, suction force, change of reserve material, and germinative capacity. The data are set out and discussed in detail. Temperature plays an important rôle in the germination of seed of both species. A temperature higher than 25° C. is unfavourable to germination, but seed could be submerged for a long period in water below 10° without its germinative capacity being affected. Tests on seed of both species after storing for 3 years in

paper bags, (a) at room temperature (-15° to $+25^{\circ}$) and (b) at a constant temperature of -15° , showed that germination of *P. glehnii* seed was about 50% in both cases, and that of *P. jezoensis* was 33% for (a) and 59% for (b).

243. HUSS, E. Kottklångning och gröningsanalys: ett à propos, till statens skogsforskningsinstituts nyinrättade klångstuga och frölaboratorium. [Extraction of conifer seed and germination testing: a topical note on the Swedish Forest Research Institute's newly-established extractory and seed-testing laboratory.] *Skogen* 36 (7), 1949 (92-4). [Sw.]

Briefly describes procedure in cone sampling, seed extraction, de-winged, cleaning and seed sampling (the seed being sent for actual germination tests to the National Seed-testing Institution), with photographs of some of the apparatus used. The Forest Research Institute will now undertake tests for forest owners at cost price, furnishing data on germination % after 10 and 30 days, yield of clean seed per hl. cones, 1,000-seed weight and % of empty and ungerminated seed. It is also collecting data on the mean viability, over a series of years, of seed from different latitudes and altitudes, in order to get a basis for the assessment of relative seed quality for a given locality in a given year. Such data are still scanty, and it is proposed to supplement them with data on the seed sent in for testing; for this purpose certain additional information is required, and the Institute will supply, free of cost, blank forms on which it may be entered.

244. TIRÉN, L. Om en snabbmetod för grobarhetsbestämning av tall- och granfrö. [A rapid method of determining the viability of Pine and Spruce seed.] *Medd. SkogsforsknInst., Stockh.* 37 (5), 1948. pp. 28. 12 refs. [Sw.sw.e.]

Describes, with illustrations, method and apparatus used for obtaining a representative sample of seed and a method for calculating the germination % from results after 10 days' germination. This method is basically the same as that described in *For. Abstr.* 8 (No. 215), but the coefficients for the equations given for Pine and Spruce differ slightly from the earlier values and it is emphasized that further modification may be necessary.

23.23.3. Methods of Sowing

See also *For. Abstr.* 11 (Nos. 289-93).

245. LOTHIGIUS, W. Streck-råtsådd. [Direct sowing in drills on screeded patches.] *Skogen* 35 (19), 1948 (221-3). [Sw.]

In this method, which is a Finnish modification of Melders' method [see *Commentationes forestales* No. 3, 1929], the ground cover and humus are carefully pared off to expose the mineral soil in patches of 10×25 to 20×30 cm. (according to the nature of the ground cover), with their long axis running E.-W. or, on slopes, along the contour. Along this axis of the patch, in the undisturbed mineral soil, a single drill is pressed in with the V-shaped edge of a special tool, to a depth of 1-1.5 cm. if the soil is firm, or shallower if it is liable to run back into the drill, since the aim is to get the optimum covering (for Scots Pine) of 0.4-0.6 cm. No humous matter should be present in the bottom of the drill. Sowing is done by hand or with a special can, and a very light covering of mineral soil effected by drawing a finger along one (preferably the N.) edge of the drill. Windblown organic particles later accumulate on top of this mineral covering. On very dry sites it may be worth placing a piece of wood 2-4 cm. in diam. and at least as long as the drill, along its S. edge.

The method is designed primarily for Scots Pine on dry or dryish sites, and is unsuitable for moister ground liable to weed invasion. Notes are included on some trial sowings of this type, results of which have been good wherever the choice of site was correct, made in Jönköping in 1931-2 and 1933 [cf. *For. Abstr.* 8 (No. 208)]. Advantages claimed for the method, as compared with other methods of direct sowing, are:—higher plant %, improved development (probably due to better moisture conservation), little risk of frost heaving, easier weeding, reduced seed requirement (0.25-0.7 kg., according to conditions, per 5,000 patches (1 ha.)) and rather lower labour requirement and cost. So far it has been little used in Sweden, but two large forest companies are said to have taken it up. Illustrations are included of tools used.

246. WIKSTEN, Å. Om några faktorer av betydelse för såddresultatet jämte preliminära resultat av några täcksåddförsök. [On some factors of importance to sowing results and preliminary results of some experiments with covered patch sowing.] *Medd.*

SkogsforsknInst., Stockh. 37 (4), 1948. pp. 34. 32 refs. [Sw.sw.e.]

Covered patch sowing, in which a layer of organic material is spread over the seed patch after sowing [cf. *For. Abstr.* 9 (No. 1533)] is recommended as reducing the danger of drought and frost-heaving. Experiments with Scots Pine and Norway Spruce showed that the method provides good protection against drought, giving a 60–100% increase in plants on seed patches covered with a layer of ant-hill litter or sawdust over the number on uncovered patches. The degree of protection against frost-heaving has not yet been determined. The additional costs of labour and transport must be weighed against the better plant % and consequent saving of seed. In further experiments mycorrhiza-forming fungi were introduced in the form of mycelial humus from a virgin stand into seed patches on an old felling area; results are not yet available. The number of plants in these patches is lower than on untreated patches, but this was to be expected as the introduction of a porous layer tends to reduce the capillary rise of water to the roots.

247. ARNBORG, T. Om såddmaskiner och såddredskap. [Machines and tools for sowing.] *Skogen* 36 (4), 1949 (50–2). 7 refs. [Sw.]

Presents brief notes on and illustrations of apparatus for sowing Scots Pine and Norway Spruce: (1) *In the nursery*: (a) The Edin-Fahlén seed drill, mounted on bicycle wheels and hand-propelled, sows 6–8 rows simultaneously and covers the seed. It has devices for regulating the number of seeds per metre and for cutting off the seed supply at the end of a bed. Both dry and steeped seed have been sown with success and the machine is eminently suitable for nurseries of more than 1 ha. in extent. (b) A simple hand-propelled single-row drill, with arrangements for regulating the rate of sowing, suitable for small nurseries. (c) Malmberg's sowing lath, for accurate sowing of small seed lots, e.g. élite seed for progeny trials. Up to 150 and more 2/0 plants per g. of seed have been obtained with this tool. (2) *In direct sowings*—with chief reference to methods using furrows on screeded patches [cf. preceding abstract]: (d) A small 3-clawed mattock for screeding and drawing the furrows. (e) Three special sowing cans, one of which has

a nose which will draw a furrow and simultaneously sow the seed. (f) A metal plate with 2 parallel V-shaped ridges, strapping on to the heel of a worker's boot and pressing out 2 furrows in the seed patch. (g) Wahlberg's 'Sälått' sowing stick, an efficient tool on most types of ground.

23.24. Formation of Stands by Planting

248. GRØN, A. H. Rational Kulturrekonomi. [Rational plantation economics.] *Dansk Skovforen. Tidsskr.* 33 (11), 1948 (484–94). [Dan.]

In connexion with the controversy on Beech establishment costs in Denmark [see *For. Abstr.* 10 (No. 1015)], Grøn presents calculations to show that intensification of plantation work (increasing the initial planting density or the number of weedings etc.) is economically justifiable only within very narrow limits, whereas there is a wide economic scope for 'extensification'. For every extra Kr. 100 per ha. spent on plantation establishment there should be prospects of hastening production by 4–5 years or improving quality (value) by ca. 20%. For every Kr. 100 saved as compared with the usual establishment costs, it will be permissible to delay production 5–6 years or decrease quality by ca. 20%. At present, much too little is known of the relation between establishment costs and yields, but a completely satisfactory result can be achieved for Kr. 1,500–1,800/ha. The first aim should be to get the same work done for less money, e.g. by rationalized methods; but it is also worth considering whether the indirect benefits which justify the retention of Beech in Danish forestry, would be significantly reduced even if stands of somewhat lower yield and quality were grown.

249. AFANASIEV, M. A study of Red Cedar plantations in North Central Oklahoma. *Tech. Bull. Okla. agric. Exp. Sta.* No. T-34, 1949. pp. 16. 8 refs.

Two plantations of *Juniperus virginiana* have been established and maintained successfully on sites which would commonly be classed as poor. Survival was generally satisfactory (about 80% in 4 years) when 1–1 planting stock was used. The use of 1–2 planting stock resulted in comparatively heavy mortality. Most losses occurred during the first year after planting. High

clay content of the soil had a detrimental effect on height growth. Heavy thinning failed to accelerate height growth during the first two years after treatment. Direct sowing was a failure.

23.24.1. *Planting Material*

See also *For. Abstr.* 11
(Nos. 80, 230, 255-60).

250. *Relation between size of plant and vigor (Pinus radiata). Rep. For. Timb. Bur. Aust. 1947, 1948 (14).*

A small experiment indicated that the largest seedlings gave the highest establishment % in the plantation, and that, at least for the first 6 years, the larger the seedling the faster the rate of growth. The investigation is being extended.

23.24.3. *Spacing. Geometric Arrangement*

See also *For. Abstr.* 11
(Nos. 289-93, 769).

251. FORTUNATOV, N. I. Gnezdovaya posadka sosny. [Patch planting of Pine.] *Agrobiologiya* 1949 (1), (92-101). [Russ.] [Lesokhozyaystvennyy Institut, Kiev, Golosev.] H.S.B.

Gives the results of measurements made in 1948 on plots in 11-year-old patch and row plantings of Scots Pine in the Russko-Polyansk forest, Cherkess Leskhov, Kiev. (1) The patches (300/ha.) were 1 × 1 m. in size, spaced 5 × 6.5 m., and each planted with 12 plants in 3 rows of 4, the middle row being staggered. Part of the space between patches was occupied by coppice Oak and shrubs. No early tending was required. (2) The rows, on a similar site, were planted at a spacing of 1.5 × 0.5 m. Results [figures for (2) in parenthesis] were:—mean diameter 6.5 (5.7) cm.; % of stems 8-10 cm. in diam. 61 (33), though the maximum diam. was 10 cm. in both cases; mean height 4.3 (3.2) m. The patch planting showed good natural pruning of the larger stems, whereas in the rows not a single tree had the first metre of stem free of dead branches. The volume and basal area per ha. of (1), including both Pine and Oak were 34 cu.m. and 9.92 sq.m., compared with 68 cu.m. and 25.14 sq.m. in (2). A considerable area of (1) was still unoccupied by the stand, whereas (2) was fully closed. Survival

in both cases was 80%, a fact which, with the growth figures, is considered to dispose of any question of overpopulation and intraspecific competition between the Pines in the patches. It is clear that the spacing between patches was much too wide for standard use, and on the basis of the results obtained it is reckoned that 1,200 patches/ha., spaced 3.5 × 2.5 m., would have given the same number of plants/ha. as in the row planting, but the volume would have been ca. 100 cu.m./ha. The differences observed are attributed to better utilization of the soil by deeper-going roots in the patch plantings and the economy in material arising from the suppression of branch development. Finally, an instance is discussed where 20- to 25-year-old Oaks of small diameter had been left on the planting site. These had adversely affected development of the Pine, no doubt owing to overshadowing.

252. NESTEROV, V. G. Ispol'zovanie opyta lesnykh kul'tur dlya stepnogo lesorazvedeniya. [The use of forest plantation experiments in steppe afforestation.] *Agrobiologiya* 1949 (1), (115-24). [Russ.] [Ministerstvo vysshego obrazovaniya, Moskva.] H.S.B.

The author headed an expedition of the All-Union Forest Research Institute (VNIILKh) to study 100-year-old plantation experiments in the Buzulukski Bor, an isolated block of forest of about 110,000 ha. in the path of severe S.E. drying winds in the Chkalov-Kuibyshev steppe. Some 170 years ago, the area abounded in bogs and lakes and had a corresponding fauna; now many of the bogs and lakes have disappeared and forest has replaced them, while elevations formerly forested bear *Calamagrostis*, *Carex*, *Phleum* etc., and often *Stipa* and *Artemisia*. Many forest stands are dead, others have been devastated by cutting or burning and have reverted to steppe. Shifting sand dunes up to 20 m. high occur locally, and these have surface temperatures reaching 70° C. This tendency to desiccation extends down to the Caspian sea, the level of which is known to have fallen 1.8 m. In the Buzuluk area Prof. Tol'ski 30 years ago planted sands with Pine at an unparalleled density—5,000 to 40,000 per ha. Here, too, plantations were made of Pine and Birch or Pine and Balsam Poplar. About 300 exotic tree and shrub species have also been tried. Many plantations have failed, especially after droughts, which tend to recur in 5-to-6- or 10-to-11-year

cycles, and have been ravaged by diseases, pests and fire. Altogether 75,000 ha. have been subject to fire, though some of this has been regenerated naturally or artificially. In the past century in the area under Pine, nearly 10,000 ha. have been planted or sown but more than $\frac{1}{4}$ of this has again failed; 35,000 ha. have been naturally regenerated. Nevertheless in 1845, steppe occupied 3,000 ha. of the area; in 1945, 17,000. Among the special aims of Nesterov's expedition was to study the condition of Pine plantations, pure or in mixture with Birch or Poplar, and of the exotics. Data were obtained on the susceptibility of these species to drought, fire, diseases and pests. Survival (1945 figures for trees with live tops) in pure Pine plantations formed in 1913-5, increased progressively from 1,437/ha. for those initially having 4,650 plants/ha. to 6,024 for those initially having 39,500. The condition of the former was pitiable, and invasion by steppe vegetation and shifting sands was in full progress. The first marked improvement was observed in the stands from plantings at 13,200/ha. The aerial and root development of the mean trees in pure stands of the varying initial densities are tabulated and illustrated in a diagram which also shows the depth of the water table for each case. Taking the balance of these factors, there appears to be an optimum for the sites concerned, corresponding to an initial density somewhere between 13,200 and 26,300 plants/ha. Passing mention is made of the superiority of balled wildlings to ordinary planting stock, as witnessed by the success of some 70-year-old plots. This is held to be due largely to the introduction of mycorrhizal fungi with the former.

In 30-year-old mixtures of Pine and Birch, survival was better than in the most open pure plantings but inferior to that in the denser ones, and on poor, dry sands, pure Pine is clearly the most suitable. Pine and Birch, or planting of Pine behind a shelterbelt of Balsam Poplar, Birch and shrubs, may sometimes be useful. Of the 300 exotics tried only 4 shrubby species appear suitable, viz. 'Sand Cherry' [*Prunus pumila?*], *Rosa rugosa*, *Amelanchier florida* and *Ribes aureum*. These may be planted with Pine in this locality.

Tables are also included to show: (1) the wide variation in survival and growth of Pine plantations on 4 different soil types of the region; (2) similar variations correlated with

relief and aspect; (3) the protective value to new plantations of pre-existing forest plantations; (4) the protection given by the N. margin of an existing stand. In this region, planting or sowings should start in the shelter of an existing stand and progress in a N.W. direction.

253. MUNTZ, H. H. **Profits from thinning variously spaced Loblolly Pine plantations.** *Sth. Lumberm.* 177 (2225), 1948 (125-8). [Southern Forest Experiment Station.]

A study of costs of planting and revenue from a first thinning of Loblolly Pine [*Pinus taeda*] planted in 1928 at 4 different spacings:— (1) 4×4 , (2) 6×6 , (3) 8×8 and (4) 10×10 ft. The thinning was made with the object of growing poles and sawlogs for the future, it removed only pulpwood-size material and was light enough to permit a second thinning in 5 years. It left an average spacing of 7.4 ft. in (1), 9.5 in (2), 11.1 in (3) and 14.1 in (4). Growth and yields obtained are summarized in a table. Plantation (3) produced the highest total pulpwood volume (31 cords/acre). Plantation (2) produced nearly as much. Plantations (1) and (4) were respectively overcrowded (despite high mortality) and overspaced and branchy. Costs and returns are summarized. No. (3) paid the best; (2) came next. As all spacings except (4) were too close for truck hauling, 1 row of trees every 2 chains was cleared for roadways.

254. WOOD, A. S. **Establishment of Oak.** *Quart. J. For.* 43 (2), 1949 (80).

As against the Forestry Commission's recommendation for spacing Oak seedlings 2 ft. apart in rows 4 ft. apart, the author recommends pit-planting seedlings 12-18 in. high at a spacing of 5 ft. in rows 6 ft. part, provided that there is plenty of Hazel, Birch, Alder or Sallow scrub to act as nurse. The scrub should be allowed to grow rather higher than the Oak during the first 3-4 years, but rank growth such as bracken and brambles must be checked. From 4 years onwards, the scrub must be kept more severely in check, and a little gentle pruning of forked stems and lopping of side branches of the Oak may be done with advantage. Treated in this way, Oaks have grown in West Herefordshire to 10-14 ft. in 10 years from planting. The essential to success is the maintenance of the correct balance between the

rate of growth of the Oak and the controlled growth of the scrub.

23.26. Plant Rearing. Nursery Practice

See also *For. Abstr.* 11
(Nos. 80-3, 247, 646-8).

255. PETRE, A. En försutten chans? [A lost opportunity?] *Skogen* 36 (5/6), 1949 (74). [Sw.]

The equipment (illustrated) for Berner's method of raising ball plants consists of: (1) A special type of plant box, with wooden sides and a perforated masonite bottom, divided by removable partitions into quarters, each of which holds 25 cardboard plant containers. The box has a detachable wire handle and is readily portable. (2) Square cardboard plant containers, open at top and bottom, each nest of 25 being held together by a loose cardboard wrapper.

Sowings in these containers are made with a sowing lath and the number of seeds per container can be precisely controlled. If the soil used has a poor water absorption capacity, a piece of jute fabric is laid between the bottom of the plant box and that of the individual containers; this helps to distribute moisture evenly to all containers. The equipment has also been used by the Swedish Forest Research Institute for propagating Pine cuttings under controlled conditions. Though it was first brought out in 1919 and later improved, the method has never received the attention that it deserves. If results of proper tests were favourable, as experience suggests they would be, the equipment could be mass produced at much cheaper prices.

256. KITH Y TASSARA, M. Un método de protección de pequeñas plantas en las repoblaciones forestales que se están efectuando en la provincia de Granada. [A method of protecting seedlings in the formation of forest stands in Granada province.] *Montes, Madrid* 5 (26), 1949 (102-4). [Span.]

The greatest enemies of forest regeneration in Spain, especially where planting out is necessary, are drought and extremes of temperature. In Granada, where the altitude brings extreme cold, successful experiments have been made in growing and transplanting Pines (*Pinus halepensis*, *P. pinaster*, *P. nigra* var. *calabrica* and *P. sylvestris*) in cylinders of

cane [type unspecified], which provide some degree of insulation. The method has proved more economical than ball-planting and more successful than planting with naked roots. The first trials were made in the autumn of 1945, when, in spite of a very dry season, losses were 17-20%, less than in ordinary plantations. The advantages were maintained in 1946 and 1947. Details of the methods used are given.

257. VEIGA, A. DE A. *Eucalyptus citriodora*. *Rev. Agric., Piracicaba* 21 (3/4), 1946 (154-7). [Port.] E.M.B.

In experimental propagation of *Eucalyptus citriodora* the following methods were tried:— (1) Broadcast sowing in seedbeds and planting out in pots. (2) Sowing in boxes at a spacing of about 5 cm., putting 2 or 3 seeds into each hole. (3) Sowing in tubes, made of the same material as match-boxes, with 2 or 3 seeds in each tube.

All 3 methods are adequate, (2) and (3) probably being more economical. The author recommends method (3), either sowing or transplanting seedlings to the tubes, which can often be used twice. The seedlings should be transplanted to their final position when they reach a height of 20-30 cm. The plant and plug of earth can be removed from the tube with ease, leaving the root system comparatively undisturbed. Fertilizer should be used sparingly.

258. WAKE, G. R. The pot planting of Eucalypts. *Bull. Minist. Agric. Lds., S. Rhod.* No. 1382, 1947. pp. 5. *Repr. from Rhod. agric. J.* 44 (1), 1947 (9-12).

Difficulties in planting Eucalypts in the Umvukwes tobacco district in north-central Mashonaland were overcome by a method of pot planting. The soil in this region being mainly sandy loam and rainfall being confined to about 5 months in the year, the 'open-root' system can only be used on wet, dull days, when all available labour is needed for tobacco planting. Seedlings are therefore pricked out in pots (bottomless earthenware cylinders about 6 in. long, interior diameter 2½ in.) which are filled with ordinary sandy top soil, and when growth is about 6 in. high, the pots are cracked in several places, and both pot and seedling planted out. A cone-shaped pot from which the seedling can be removed for transplanting has also been used with success by the author, who gives instructions for making such pots.

259. STEFANSSON, E. Lagringsförsök med granplanter. [Storage experiment with Norway Spruce plants.] *Skogen* 36 (9), 1949 (117-8). 1 ref. [Sw.]

The plant-packing apparatus discussed by Hallander [see *For. Abstr.* 9 (No. 1554)] came into fairly large-scale use in spring 1948 at the Sundmo branch of the Swedish Forest Tree Breeding Association. A small-scale experiment was made to compare the effects of storage for 7, 14, and 26 days on the paper-wrapped bundles of stock, as turned out by this device, and on ordinary bundled stock packed in wooden trays. The stock used included puddled and unpuddled 3-year-old plants, and a comparison was also made of storage in a cellar with storage outdoors. Both in the paper bundles and in the boxes, moist sphagnum was used as an insulating material. The paper bundles were about 90 cm. long and two layers of paper were used.

Whether in the cellar or outdoors, none of the plants showed any deterioration at the end of 14 days. After 26 days' storage, plants in all the treatments had some signs of deterioration. Of the cellar-stored plants all had a little mould and some showed a slight needle yellowing, but none developed shoots and their condition was surprisingly good. There was no significant difference between boxed and paper-wrapped stock. The plants stored outdoors in boxes were not good: though mould was absent and few plants showed yellowing needles, injuries caused by drying out were considerable especially among the unpuddled stock, and some of the buds had flushed. Of the paper-wrapped stock, which appeared in somewhat better condition, none suffered from drying out and none had flushed, though there was a relatively high proportion of plants with some yellowing. On the whole, the condition of the stock stored outdoors was poorer than that in the cellar. All plants stored for 26 days were planted out in the forest on June 8-10. The plantations were fairly successful in spite of unfavourable weather, mortality varying from 4.6 to 9.4%. When inspected and graded [in the autumn of the same year?] the plants from all treatments scored much the same number of points.

The evidence is thus that the paper-wrapped bundles are in no way inferior to bundles packed in boxes. The bundles, especially if stiffened by 3 splints and having a double layer

of paper, are durable enough for quite long rail or road transport, and cost far less than boxes in freight. For 2/2-2/3 Norway Spruce it is desirable that the bundles should be ca. 120 cm. long, but with suitable overlapping the wrapping paper need not be more than 100 cm. wide.

260. ARONSSON, G. Om frostsador på granplanter. [Frost damage to Norway Spruce nursery stock.] *Skogen* 35 (13), 1948 (160). 1 ref. [Sw.]

Frost-damaged 2/1 Norway Spruce stock at Deje nursery, Värmland, was graded in May 1947 according to the degree of damage, the bulk falling into grade 5, i.e. having 80-100% of the foliage damaged. Over 700 plants, 683 of which were in grade 5, were left in the beds till September 1947, when an inspection showed that 74% had dead terminals and 18% were completely dead. In the same spring five hundred plants (100 of each of the 5 grades) were planted out on forest land. Of these 95% had dead terminals in September. Plants completely dead varied from 11% in grade 1 to 95% in grade 5, those of grades 1 and 2 (up to 40% of the foliage damaged) showing good recovery. [Cf. *For. Abstr.* 10 (No. 1382).]

261. JONES, L. H. Toxic effect of wood preservatives on plants. *Bull. Mass. agric. Exp. Sta.* No. 436, 1946 (24).

In previous work with lumber impregnated with asphalt, injury to seedling plants was traced to a small quantity of creosote which had not been removed from the resins. It has now been demonstrated that when the creosote is entirely removed there is no injury to plants from such treated wood. It has been generally understood that the greatest damage done to green leaves by creosote fumes is due to the toxic action of the gas entering the leaf through the stomata. It now appears that damage may also be caused by the dissolution of the leaf, which exposes the tender cells to the dehydrating effect of dry air.

262. DORAN, W. L. Damping-off and growth of seedlings and cuttings of woody plants as affected by soil treatments and modifications of environment. *Bull. Mass. agric. Exp. Sta.* No. 436, 1946 (20-1).

Different clones of *Tsuga canadensis* were found to respond very differently to the same treatments, e.g. cuttings from some clones

rooted better after treatment with indolebutyric acid while those from others did not. Supplementary treatment with the fungicide Arasan (tetramethyl-thiuram-disulphide), applied after treatment with a growth substance, did not improve rooting. Treatment of Holly cuttings with Fermate (ferric dimethylthiocarbamate) or Spergon (tetrachloro-parabenzquinone) after treatment with indolebutyric acid, resulted in a smaller percentage of rooting than did acid treatment alone. A root-inducing treatment, which was applied with benefit to cuttings of Holly taken in October, was apparently injurious to cuttings taken in January. [Cf. *For. Abstr.* 9 (No. 102).]

Surface watering was compared with sub-irrigation as factors affecting rooting of cuttings of conifers. Cuttings of Hemlock, Hinoki Cypress [*Cupressus obtusa*], two species of Fir and two species of Spruce taken in November, rooted better in sand watered from above than in subirrigated sand.

263. POURTET, J. Entretien des pépinières: quelques precautions importantes pour la réussite des semis. [Nursery practice: some precautions of importance for successful sowings.] *Rev. for. franç.* No. 1, 1949 (14-7). [F.]

Sowing early in a sterile or acid soil is recommended to prevent damping off. From sowings of Corsican Pine made at Barres on April 10, April 25, and May 10, the respective numbers of seedlings established were in the proportion 100 : 57 : 37. Similar figures for Scots Pine sown at Prades in the Pyrenees were 100 : 54 : 1. Scots Pine sown at Barres (a) in untreated nursery soil, (b) in river sand, (c) in 2-3 cm. of sawdust in a trench, gave relative numbers of established seedlings 100 : 378 : 354.

Hexachlorocyclohexane products disked in to the nursery soil, before sowing or lining out, at a rate of 3 kg./are, prevent attack by cockchafer grubs for a whole season. The only apparent disadvantage of this treatment (of negligible importance in forest nurseries) is that the strong smell of the chemical precludes the use of treated soil for growing root vegetables for some months after treatment.

23.27. Arboriculture

See also *For. Abstr.* 11 (No. 650).

264. ROWE, W. H. *Tree and shrub growing*. Faber & Faber Ltd., London.

Revised, 1949. pp. 234 + 92 photos, 36 drawings. Price 18s.

With descriptions of about 850 trees and shrubs, suitable for British conditions.

265. LE SUEUR, A. D. C. *The care and repair of ornamental trees*. Country Life, Ltd., London. Revised and enlarged, 1949. pp. 224 + 40 plates. 21 refs. 4 dgms. Price 18s.

266. ЛЫПА, А. Л. Zelenoe khozyaystvo v Donbasse. [Decorative town and roadside plantings in the Don Basin.] *Priroda, Moskva* 38 (1), 1949 (48-58). 30 refs. [Russ.] A.C.P.

Contains lists of recommended trees and shrubs for planting in streets, squares and parks, on roadsides etc. A special list is given of species tolerating gases and smoke, for planting in mining and factory areas, including the following trees: *Thuja occidentalis*, *T. orientalis*, *Juniperus virginiana*, *Acer negundo*, *Tilia* ('Crimean'), *T. tomentosa*, *Populus canadensis*, *P. simonii*, *P. nigra*, *P. nigra* var. *italica*, *P. laurifolia*, *Robinia pseudoacacia*, and *Gleditsia* [sp.].

23.3. Afforestation

See also *For. Abstr.* 11

(Nos. 53-4, 57, 252, 288, 297).

267. TUZSON, J. Alföldfásítási kísérletek néhány idegenföldi fafajjal. [Trials of some exotics for afforestation on the Great Plain of Hungary.] *Erdész. Lap.* 82 (3; 4), 1943 (113-9; 151-62). [Hug.f.e.]

Notes and recommendations on numerous exotics, tried in the past at various places in the Great Hungarian Plain, and in the Mátra, many by the author himself:—*Abies concolor*: Strongly recommended as frost- and drought-hardy. After a slow start, it grows rapidly and reaches a large size. *A. grandis*: On the author's plantations in the Mátra the saplings when 1-2 m. high show some browning of the needles, probably due to the dry atmosphere. In other districts there is no such complaint. *A. nordmanniana*: Like *A. concolor*, grows rapidly after a slow start, and stands both cold and drought well, flourishing remarkably even on sunny sites. Judging from 15- to 20-year-old specimens it will do in both loess and sandy soils. *Chamaecyparis lawsoniana*: Seed of

American origin has produced specimens varying greatly in colour of foliage and growth form, including the fine and slender var. *fraseri*. Specimens 6-7 years old have seeded copiously, the seed germinating well in the nursery in the second year. Strongly recommended. *Juniperus virginiana*: The seed must be collected quickly in October-November to forestall migratory birds, which can strip a tree in a few hours. The wind scatters it easily too. Nursery sowings germinate only in the second year. Although the young trees are not delicate and develop well, careful transplanting with a ball of earth is necessary at 4-5 years old. Recommended for drift-sand and marshy wastes on the Plain, and for parks. *Picea abies* var. *glauca* (Tuzson): This variety, described and illustrated by the author [Erdész. Lap. 71, 1932 (435-7)], forms a plantation of 1.5 holds (1 hold = 1.42 acres) on the author's estate at Tar. The origin of the seed could not be established but the variety is distinguished by bluish-grey, almost silvery foliage, a characteristic not appearing until the second decade of life, and by flourishing in the drier and much warmer environment of the Mátra, well below the Common Spruce indigenous to the Carpathians. Otherwise generally similar in growth form, it shows a fine, slender trunk, averaging 20 m. high, with comparatively slim branches hanging curtainwise, and exceptionally strong, bristling needles. The whole plantation is healthy, suffers little from *Chermes abietis* and is regenerating naturally here and there in the surrounding Oak and Hornbeam forest. Indeed, it gives the impression that it could be grown at still lower levels. Experimental plantings are in progress to test its suitability for the sandy steppes of the Plain. Meanwhile it is strongly recommended for the lower hills (Mátra, Bükk etc.) especially in valleys and on northerly aspects. *Picea omorika*: Germinates fairly well but on the author's estate the young trees have grown slowly. *Pinus contorta* var. *latifolia*: Seed from Washington has produced trees exceptional for early rapid growth (shoots 60-70 cm.), healthy development and resistance to drought, on the author's estate. Nursery specimens were 4 m. high at 7-8 years, with the top covered with cones. Promises well for the Plains and also as an ornamental. *P. resinosa*: Has developed as promisingly on the author's Mátra estate as *P. contorta*; unharmed by frost, drought or inferior soil. *Pseudotsuga taxifolia*

var. *viridis*: On the author's estate at Tar sowings on deep soil of medium quality gave trees 7 m. high in 12 years. Germination was good, about 50% in the first year, rising to 70-90% in the second. Var. *glauca* grows much more slowly than *viridis*, while *caesia* is intermediate. The author considers Douglas Fir a promising species for afforestation in the Plains; it stands the climate well and puts on good, rapid growth on sandy steppes (*puszta*) and even on stony soils, notably *caesia* and *glauca*. He strongly advises, however, using it in mixture, recommending for this purpose *Prunus serotina*, *Abies alba*, *A. concolor* and *A. nordmanniana*. Other conifers mentioned are *Ginkgo biloba*, *Larix decidua*, *Picea pungens*, *Pinus montana* [mugo], and *P. echinata*.

Acer negundo: Considered of first importance for afforestation. Easy to grow on sandy wastes, shooting up rapidly once it is established and providing, in 2-3 years, large quantities of vine and garden stakes. Young trees are soon 4-5 m. high and form a windbreak right down to the ground, a valuable characteristic in the Plain where winds carry sand. *Castanea sativa*: Does well in Hungary and is important for afforestation. At Tar 10- to 12-year-old trees from large seed of Italian origin had begun to bear a few nuts. Normally stands transplanting and if it should die back, will send up shoots from the stool. *Corylus* spp.: Recommends propagation by layering (although his own experience so far indicates that trees from sowings yield nuts undiminished in size; they bear, however, only after 5-6 years) and planting at the rate of 400 trees per hold. Good, porous soil is essential. Row crops may be grown in between, unless propagation by layering is practised intensively. Hazel cultivation has been neglected in Hungary, but Tuzson's trials with 40-50 varieties from various parts of Europe, planted in sandy soil, over considerable areas, in flat and hilly districts, show that the right kinds, properly cultivated, will yield abundantly, 12-1,500 kg. per hold being a reasonable expectation. *Gleditsia triacanthos*: For hedging, best grown in triangular formation in two rows 30 cm. apart; seedlings should be one to two years old and 30 cm. high. The hedge grown thus densely is cut back at the required height and the lower branches interwoven horizontally, quickly producing a hedge impenetrable to man and beast. *Juglans nigra*: Does extremely

well and deserves much more consideration in Hungary, though only on deep, healthy soil, where it reaches a height of 30 m. It develops well on sandy areas of the plains. Should not be put on poor, stony soil, where it just languishes. It is completely winter-hardy and nothing like so sensitive to heavy frost as the common Walnut. In the author's experience the seedlings will not stand transplanting and direct sowings are advisable. It germinates very well. *Maclura pomifera*: In Hungary used with great success as a hedge but its winter-hardiness recommends it for trial as a plains timber tree. The seed germinates well but the seedlings require a sunny bed. *Populus angulata*: Grows well in Hungary and, in comparison with other species, is grateful for dampness and good soil. *P. balsamifera*: A fine quick-growing tree, invaluable for afforestation. On the plain can be planted in the most various soils and hence is one of the most important species of Poplar. Trunks 30 m. high and of enormous girth are not uncommon. In Hungary it forms extensive forests in damp places along rivers. *P. berolinensis*: Grows excellently and is strongly recommended for plains afforestation. Height up to 30 m. *P. 'canadensis'*: Of less importance in Hungary than *P. angulata*, *P. berolinensis*, *P. suaveolens*, *P. thevestina*, and *P. virginiana*. *P. robusta*: Grows rapidly into a very big tree, and is therefore a favourite and valuable forest tree. *P. serotina*: Grows to 40 m. and is valuable for forest and avenues. *P. suaveolens*: Reaches a height of 30 m.; a fine tree of great value for forestry purposes. *P. virginiana*: A very vigorous, tall-growing poplar, strongly recommended for avenues and forestry alike. *Prunus serotina*: Considered to have an important future for afforesting sandy wastes, since it has proved cold- and drought-hardy and maintains itself well in poor soil conditions. Should make a good mixture with certain conifers, at least as a nurse. Particularly suitable for hedging, forming any shape required. These qualities, despite its characteristic shortness of bole (2-3 m.), recommend it more than *P. ssiiori* which the author experimented with as the most likely rival: the latter developed from sowings into fine, long stems in 7-8 years and stood the winters excellently but could not compare as a hedge or in beauty of foliage. *P. serotina* germinates and transplants well, although care is needed in planting out,

especially in dry soils, which cause die-back. Most of the stools, however, re-sprout. *Quercus borealis*: Because of its rapid growth and resistance to drought, it should be useful for afforestation. Seed germinates extremely well. Saplings 1-4 years old can be successfully planted out, particularly if they have been transplanted in the nursery, but the larger plants are liable to die back. *Q. palustris*: Thrives in Hungary, and is entirely frost-proof. From scattered evidence to date, the author is certain it has an important future on alkali (*szik*) soils and should meantime be planted with other alkali-tolerant species such as *Elaeagnus angustifolia* and *Tamarix tetrandra*, and in more mildly alkaline places with Poplars and Oaks. *Salix viminalis*: For osiers, cuttings should be 25-30 cm. long and planted 30 x 30 cm. with one bud above ground. Yields are ca. 8-12,000 kg. per hold. *Tilia tomentosa*: This indigenous plains species, with its rapid growth, has great potentialities for the sandy wastes. *T. americana* also has possibilities as a forest tree in the plain, and develops well in mixture with *T. tomentosa*. Other hardwoods touched on include *Acer palmatum*, *A. pseudo-platanus*, *Aesculus rubicunda*, *A. hippocastanum*, *Fraxinus americana* and *Rhus typhina*.

268. VAZEILLES, M. Le plateau de Millevaches. [Afforestation of] the plateau of Millevaches.] *Bull. Com. For., Paris* 13 (81), 1948 (999-1013). [F.]

An account of the reclamation and afforestation of some 156,000 ha. of barren heathland in the Limousin. Notes are given on the behaviour of various exotic species in the experimental plantations at Puy-Chabrol, established in order to discover suitable species for afforestation of the area.

269. ZAJACZKOWSKI, M. Mountain planting in Italy. *Quart. J. For.* 43 (1), 1949 (18-23 + 4 dgms.). Translated by J. Lubanski and J. W. Mackay.

Describes methods of planting used on steep eroded slopes of the Apennines:—(1) cultivated patches (*bucche*), (2) contour terracing (*gradoni*), (3) discontinuous terracing (*piazzole*) between widely spaced contour terraces. The costs of making patches and terraces are very high (80 man-days/acre for preparation and planting). A brief account of nursery practice is given.

270. BELTRAM, V. Pogozdovanje Krasa ni problem. [Afforestation of the Karst is no problem.] *Gozd. Vestn.* 5 (1, 2), 1946 (9-18; 29-39). [Sloven.]

Using the report of the Karst Afforestation Commission as a basis, the author reviews the afforestation done between 1886 and 1911 in the Karst region of Slovenia in the light of his own experience in the Dalmatian islands, which are also of Karst type. He emphasizes that the undertaking, which consumed 45 million seedlings (1) was exclusively a planting one, direct sowings being neglected; (2) favoured an excessive use of *Pinus nigra*, which constituted 91% of the planting stock. In the course of the work, 71% of the entire stock had to be replaced, partly because of the long distances between nurseries and planting sites, and partly because *P. nigra* is not suited to the region or to the sudden change of environment involved in the transplanting. Once established, it grew well enough but in later years showed little ability to regenerate itself naturally. By contrast, *P. sylvestris*, of which the Commission put down just a few trial individuals, has regenerated abundantly, spreading into the *P. nigra* stands and colonizing large areas of bare land. Its growth and stocking may not be very fine but it is at least sturdy and vigorous.

From his experience in the Dalmatian islands the author advocates sowing rather than planting, and the following methods, which are 60-80% cheaper:—(1) on loose, gravelly soil, simple scattering; (2) on more compact ground, spot cultivating in the form of saucer-shaped patches (with sticks or hoes) and mixing the fine soil and seed; (3) on shallow, compacted ground, digging about 8 in. deep over the whole area, broadcasting the seed and protecting it from birds and the weather with branches. Where planting cannot be avoided, small local nurseries must be established. It will be necessary to use fertilizers, e.g. lime, wood ash and stable manure, to correct deficiencies (of which lime deficiency is the commonest), and to maintain soil fertility in these nurseries. In the hot climate of the Dalmatian coast, timely watering is also essential, i.e. in the spring. Bare (limestone) rock can be planted by means of a steel-bladed tool, of local design and weighing 5-6 kg., which cuts a 10-in. vertical hole for the plant and packs it there by leverage from an adjacent cut. The ground should then be shallowly hoed in a circle of 30 cm. diam.

round the plant, weeded, and covered with a thin layer of sand or gravel. The common practice of placing large stones round the plant is a bad one, as re-radiation from the stones dissipates instead of conserving soil moisture.

For species too sensitive to transplanting, e.g. *Ceratonia siliqua* and *Pinus halepensis*, the following method is recommended: paper containers or, even better, tubes some 12 in. long and 1 in. in diam., made from sunflower stems, are filled with fine humus, packed firmly in a box with ordinary soil and each sown with 2-3 seeds. Only the best seedling is allowed to grow; it is planted out complete with its container. For bare porous Karstland in general the author specifies and recommends the following:—*Pinus halepensis*, vars. *parolinii* and *brutia* and their excellent hybrid, *P. strobus*, *P. pinaster*, *Cedrus deodara*, *C. atlantica*, and *Abies cephalonica*, as well as hardwoods where they can grow.

271. DENUYL, D. Forest plantations, their establishment, growth and management [in Indiana]. *Circ. Ind. agric. Exp. Sta.* No. 331, 1948. pp. 31.

23.5. Underplanting. Nurses. Filling Gaps (Beating up)

See also *For. Abstr.* 11
(Nos. 254, 289-94).

272. DONS, H. Undervækst under Eg. [Underwood for Oak.] *Dansk. Skovforen. Tidsskr.* 33 (7), 1948 (261-313). [Dan.]

Interest in the underplanting of Oak with various species was strong in Denmark in the latter half of the 19th century and has revived somewhat in recent years. In 1944 the author received a grant for a study of the stands so formed, the results of which are presented. Owing to the great variation between localities and in the species and mixtures concerned, as well as to the lack of data expressible in figures (detailed records of stand history having proved rare) and the fact that Oak is now rather differently treated as compared with, say 30 years ago, it has been found impossible to draw hard-and-fast, objective conclusions. The need for a type of underwood that will suppress Oak epicormics is still contested, a minority claiming that clear Oak can be grown by rather heavy and frequent thinnings, rendering possible the use of an economic rather than a

'protective' type of underwood. This may be true of some very good sites, but is probably not so for the lighter soils. Site and the competition between overwood and underwood for light, soil moisture and nutrients, are the factors of first importance in deciding what form the underwood should take. Each case must be decided on its merits, but it is hopeless to expect any considerable financial yield from underplantings in the poorer Oak quality classes (from 3 downwards), and these should be left to develop natural underwood unless the poorness of the site is due to a high water table. Oak woods treated by present Danish methods show 3 main phases—(1) with a natural underwood of suppressed Oak, under more or less closed Oak canopy, into which the suppressed trees will never grow but will be gradually removed; (2) gradual invasion of the floor by the many natural associates of Oak, a process which, though slow, is almost inevitable; and (3) a stage where tall species such as Beech, Hornbeam, Elm etc., tend to grow into any available space in the main canopy. There is no advantage in artificially introducing underwood until the appearance of phase (2), normally between 40 and 60 years, shows that conditions are becoming suitable. Since Oak has a very wide site tolerance, almost all the native woody species may be naturally associated with it. For underplanting, however, the risk of deer damage has usually restricted the choice of native species to those like Beech, Sycamore (*Acer pseudo-platanus*), and Hornbeam.

The bulk of the paper is devoted to notes on combinations of Oak with the following types of underwood:—(1) *Natural growth*: All the common trees and shrubs are liable to occur, and variations are so manifold that each must be treated on its merits. (2) *Beech*: Has been much used and can be introduced on all areas where underplanting has any economic prospects, while on poorer sites it often comes in naturally. The combination can be treated in many different ways and should be variously handled according to the particular circumstances. (3) *Hornbeam*: Liable to grow too high on certain sites, but stands topping well and is often useful. A mixed underwood of Beech and Hornbeam can be easier to keep in a storeyed condition than pure Beech. Deer, however, will ruin underplantings of Hornbeam, and this is its greatest disadvantage, since

fencing is generally impracticable. (4) *Maples*: Sycamore is probably inferior to Beech for most sites, but appears to be the ideal underwood in a few places intermediate between Beech and Ash sites. It must have a good, moist soil with moving groundwater, if it is to do well. Norway Maple has apparently not been tried as yet. Field Maple is not out of place in natural underwood, but is not likely to be worth planting. (5) *Wych Elm*: Little tried, but likely to compete seriously with Oak, even on the better sites. (6) *Ash*: Of no use as underwood proper, though a sprinkling of Ash in the underwood may be desirable on suitable sites as a reserve for filling odd gaps in the main canopy. (7) *Lime* (*Tilia cordata*): Tried in the past 20 years or so, and the trials are worth watching. Is liable to get too high, but can be topped repeatedly if necessary. Form can be reasonably good, and the wood is in demand for core stock, where knots are unimportant. Seriously susceptible to deer damage. [7b] *Prunus avium*: Apparently not tried for underplanting, but so promising in nature that trials are urgently needed. (8) *Norway or Sitka Spruce*; *Silver Fir*: The Spruces are possible underwood species for a few of the very best, moist sites, but as the hardwoods are also good on such sites and as the large yield of Spruce appears to involve a smaller Oak yield, the economic advantage is doubtful. Silver Fir has no special advantages. (9) *Western Hemlock*, *Western Red Cedar* and *Lawson Cypress*: The first-named is untried, but worth trying. The two latter have been tried but do not appear very promising. (10) *Christmas trees and decorative foliage*: *Abies nordmanniana* may be worth trying for Christmas trees grown as low underwood. The market for decorative foliage in Denmark is locally very good, and species used include *Abies nobilis*, *Holly*, *Mahonia*, *Prunus laurocerasus*, *Aucuba japonica* and *Rhododendrons*, all of which may possibly be worth trial as underwood species.

273. TULSTRUP, N. P. Bøgeundervækst under Eg: nogle økonomiske Betragtninger over dens Værdi som selvstændig Bevoksning ved Egenes Afdrift. [*Beech underwood under Oak: some economic considerations with regard to its value as an independent crop after removal of the Oak.*] *Dansk Skovforen. Tidsskr.* 33 (8), 1948 (341-57). [Dan.dan.]

Reports on data obtained by the author from measurements made in 4 different Danish forests in 1946 to study the growth of Beech underwood, some idea of its possibilities having been suggested by the development of good closed stands from underwood which, for one reason or another, had had to be held over after removal of the Oak overwood. In all cases the Beech plots measured had reacted favourably and quickly to release. The most comparable series of plots examined were of Beech 51-78 years old which had been left to grow on since 40-50 years of age, when the *ca.* 130-year-old Oak had been removed.

The Beech reacted so strongly that its c.a.i. (in merchantable volume down to 5 cm. diam.) soon exceeded that of normal Beech of quality class II, converging with the curve for that class at *ca.* 80 years old, by which time the curve of merchantable stand volume appeared to be flattening out to run parallel to and a little below that of quality class II.

Making certain reasonable assumptions, the author calculates outturn from thinnings and price curves for the outturn, in order to examine the profitability of holding over such underwood instead of replanting to Norway Spruce or hardwoods. He concludes that for quality class II, at least, the marginal profitability (indicating %) of such Beech stands will be favourable in comparison with replanting to Spruce, and still more so in comparison with replanting to hardwoods. The financial rotation for the Beech is calculated at 76-80 years.

Stress is laid on the modest scale of the present study and it is urged that more comprehensive ones should be made in view of the interest of this question for Danish forestry.

274. Underplanting of pure plantations. *Rep. Wkg. Plans Silv. Ent. For. Dep. Burma 1940-1, 1949 (63-4).*

In 1937 some experiments were started to see whether it was possible to introduce some saleable species as an understorey in plantations in plains reserves. It was assumed that these areas would be regenerated by coppice and thought probable that the resulting crop would be better stocked than if there were only the crop of the overwood present. *Homalium tomentosum* was chosen as a suitable species, as it will endure heavy shade and yields first-class fuel. Stumps were planted in (a) a

heavily thinned Teak plantation, all undergrowth and litter removed at time of planting; (b) as (a) but undergrowth and litter not removed; (c) a Cutch [*Acacia catechu*] plantation, open above but with a heavy undergrowth; (d) a *Gmelina arborea* plantation, also open above and with a heavy undergrowth. Results in 1941 were as follows:—

	Survival %	Mean height (inches)
(a)	40	24.1
(b)	70	18.2
(c)	40	42.2
(d)	48	14.0

23.6. Care and Inspection of Regeneration in the Initial Stage of Establishment

275. CANDY, R. H. Reproduction survey. *Woodl. Res. Index Canad. Pulp Pap. Ass. No. 54 (F-2), 1949. pp. 4.*

The first stage of the Dominion Forest Service's Reproduction Survey has now been completed. A short summary is given of the findings for the regions east of the Rockies. The most striking single factor was the disastrous effect of fire following logging, on future coniferous stands, except in the sub-alpine and foothill forests of Alberta, where it improved reproduction.

The methods of recording data on punched cards are discussed. Experience gained after 3 seasons is as follows:—The punched card stands up to normal survey conditions better than paper forms, and no difficulty was found in punching cards in the field. Cards are convenient to handle in the office during compilation and can be quickly sorted by the needle for any factor under study. The greatest damage to cards is caused by their being packed too tightly in containers. [Cf. *For. Abstr.* 11 (No. 752).]

Certain features of the survey as originally planned have been a failure, and it is recommended that they should be dropped; these are crown canopy %, density of underbrush and density of herbs, slash, soil moisture and depth of litter in inches, seed supply and health of reproduction. These will be better studied in more detail by experienced foresters in the second stage of the survey.

24. TENDING OF STANDS AND TREES.

See also *For. Abstr.* 11 (No. 216).

276. BUNDY, O. Några tallars vittnesbörd om mänsklig visdoms fåfänglighet. [The testimony of some Scots Pines on the vanity of human wisdom.] *Skogen* 36 (9), 1949 (119-20). [Sw.]

Examines growth data for a patch of 8 trees of Scots Pine in an even-aged stand raised by direct sowing 48 years ago (1901), in which the intended crop trees were dry-pruned and numbered in 1926. No thinning was done, and the stand has remained undisturbed. On the patch discussed, a scale diagram of which is given, two numbered trees are moribund or dead, as are also two unnumbered trees, and three unnumbered trees show seriously retarded growth. The one remaining Pine, which is growing vigorously, was not selected as a crop tree, but has nevertheless made steady and uninterrupted diameter growth averaging 5.2 mm./year since 1924 and is the tallest tree on the patch. The author infers that a safe assessment of vigour in Scots Pine trees cannot be made before their 30th year. He suggests that if young Scots Pine were allowed to remain untouched (apart from the removal of technically defective or undesirable trees) up to 30 years of age or until 8-10 m. high, it should be possible to make a reliable selection for vigour of growth and to continue this so as to leave the most vigorous trees as seedbearers.

It is also stated that many trees of this species which were dry-pruned when this practice was in vogue about 20 years ago, have been unable to withstand the competition of their neighbours.

24.2. Thinnings

See also *For. Abstr.* 11 (No. 253).

277. Practicability of thinning Black Spruce [*Picea mariana*] for pulpwood. *Rep. Lake St. For. Exp. Sta.* 1948, 1949 (10).

Experiments showed that thinning of young Spruce and use of the thinnings for pulpwood were both economically and technically practicable. [Cf. *For. Abstr.* 10 (No. 308).]

278. Results of thinning Lodgepole Pine. *Timberman* 50 (6), 1949 (112, 114).

According to a study made by the U.S. Forest Service of a 70-year-old Lodgepole Pine

[*Pinus contorta* var. *latifolia*] stand in the Roosevelt National Forest, the dominant trees had doubled and the intermediate ones tripled their rate of diameter growth in the 11 years following a thinning made in 1935. The rate of diameter growth in the dominant trees was approximately 1 in. in 8 years; in the intermediate trees 1 in. in 9 years. In an unthinned stand in the same area, rate of growth had established itself at approximately 1 in. in 17 years for the dominant trees, and 1 in. in 29 years for the intermediates.

279. STEELE, R. W. Light thinning in century-old Douglas-Fir. *For. Res. Notes Pacif. Northwest. For. Range Exp. Sta.* No. 43, 1948. pp. 3.

280. WARRACK, G. Treatment of Red Alder [*Alnus rubra*] in the coastal region of British Columbia. *Res. Note B.C. For. Serv.* No. 14, 1949. pp. 7.

Preliminary results of a thinning study started in 1948 indicate that a suitable time for a heavy thinning of pure Alder stands on good sites would be between 15 and 20 years. This should assist in the production of a merchantable stand within a 30- to 40-year rotation. The occurrence of epicormic branches may be a factor in determining rotation and density requirements.

281. LØVENGREEN, J. A. Extrem Udhugning i Eg. [Extreme thinnings in Oak.] *Dansk Skovforen. Tidsskr.* 34 (3), 1949 (97-135). [Dan.]

Presents and analyses in detail the results of a special mensurational study of the extremely heavily thinned Oak at Bjerger Eng [cf. *For. Abstr.* 10 (No. 1055)], concluding that this type of thinning will result in a loss, both of volume and value, of at least 23% compared with what an ideal stand on an equivalent site should produce, and of 10-15% compared with the general standard of Oak growing in Denmark.

282. [Thinning of *Sarcocephalus diderrichii*.] *Rep. For. Adm. Nigeria* 1947-8, 1949 (22).

Thinning was carried out on Opepe [*Sarcocephalus diderrichii*] plantations in the Omo reserve. These very straight clean poles are more than 90 ft. high and up to 5 ft. in girth at 30 years, but their conspicuously small crowns have not responded to thinning and there is

little sign of canopy even in the oldest compartments. It is possible that Opepe crowns are naturally intolerant of contact. If that is so, underplanting with another species at a comparatively early age will probably be required to form a canopy, in which Opepe can be the emergent species.

24.3. *Opening of the Canopy. Release and Improvement Fellings (including Poisoning and Girdling)*

See also *For. Abstr.* 11 (Nos. 644-5).

283. HELMERS, A. E. **Disintegration of girdled Western Hemlock and Grand Fir.** *Sta. Pap. Nth. Rocky Mt. For. Range Exp. Sta.* No. 17, 1948. pp. 14. 4 refs.

Overmature trees of *Tsuga heterophylla* and *Abies grandis* were girdled on two areas in 1934 and 1935, and the effects observed until 1946. The results were as follows:—Cone production was unaffected during the two seasons after girdling while the trees were still physiologically alive. Symptoms of decline in vigour of the girdled trees occurred in 2 months and 9 months respectively on the two areas. Trees died 3-4 years after girdling. Needle-fall began 4 months after girdling. Disintegration progressed gradually from the finer to the coarser branches. Bark on the main stem began to crack and scale off 5-8 years after girdling. Disintegrating trees caused only slight damage to the reproduction stand. Girdling is not advisable where large numbers of trees per acre are to be killed, because of the high fire hazard it creates, but it should be useful and cheaper than felling for scattered trees. *From author's summary.*

284. **Ammate crystals—an effective poison for undesirable Ponderosa Pine.** *Rep. Sthwest. For. Range Exp. Sta., 1948, 1949* (4-6).

Ammonium sulphamate or 'ammate' was tested on a small scale to determine its effectiveness as a killer of Ponderosa Pine. It is clear that ammate in either crystals or solution can be used to kill Ponderosa Pine and that it is about as effective as the highly toxic sodium arsenite. The use of crystals is more convenient than that of solution; they were placed, dry, in notches cut into the tree with an axe, 12-18 in.

above the ground and 6 in. apart. One tablespoonful was put in each notch. [*Cf. For. Abstr.* 9 (No. 2209).]

285. [1] **Mesquite control.** [2] **Basic studies of physiology and ecology of Mesquite** [*Prosopis juliflora* var. *velutina*.] *Rep. Sthwest. For. Range Exp. Sta. 1948, 1949* (35-47).

(1) Summarizes recent developments in the oil method for killing Mesquite [*cf. For. Abstr.* 10 (Nos. 684-5)], and the effects of Mesquite thinning on frequency and yield of perennial grasses. [*Cf. For. Abstr.* 8 (No. 2416).]

(2) Work done during the year was centred on determination of the rate, extent, and path of movement of promising herbicides when introduced into a Mesquite stem under controlled conditions, and how the movement of these killing agents is affected by temperature, humidity, soil moisture, and stage of growth of the plants. Another phase of the work dealt with Mesquite reproduction. Preliminary findings are briefly given.

24.4. *Shelterbelts. Windbreaks*

See also *For. Abstr.* 11 (Nos. 54, 56).

286. JOHANSSON, E. **Läplanteringar vid fruktodling.** [**Shelter plantings in fruit growing.**] *Fruktodlaren* 1944 (1), (12-3). [Sw.] E.M.B.

This abstract of an article by H. Larsen in *Erhvervsfrugtavlaren* No. 5, Feb. 1, 1944, reviewing Danish studies of the influence of wind on fruit-growing, mentions that Lombardy Poplar is suitable for a windbreak 'hedge' that will be removed after about 10 years. Leading fruitgrowers in Scania recommend *Populus berolinensis* as a quick-growing species with less tendency to suckering than some others and valuable in hedges of more permanent species.

287. SPAFFORD, W. J. **Breakwinds and shelters for farms with calcareous soils.** *Journal of the Department of Agriculture of South Australia, Adelaide* 51 (9), 1948 (439-46). L.S.

Explains the lack of trees and advantages of shade and shelter in the farming areas of Yorke Peninsula, S. Australia, which are characterized by calcareous soils and low rainfall (average less

than 20 in. annually). Competition for moisture with field crops can be prevented by running a subsoiling furrow alongside the trees every year when the field is being ploughed. Protection from rabbits and farm stock is necessary for the first few years. It is advisable to plant if possible in any place where there is a chance of water running after rain, e.g. water runs from roads or stony hills. Trees must be widely spaced to avoid intense competition, but adequate wind-breaking effect can be obtained by planting several staggered rows. A suggested wide windbreak designed to lift the wind, consists of the following rows:— (1) Athel [*Tamarix aphylla*], (2) Dwarf Sugar Gum [*Eucalyptus cladocalyx* var. *nana*], (3) *Pinus canariensis*, (4) as (2), (5) as (1).

Notes are given on the use of empty jam or fruit tins as planting tubes. The tins are filled with soil after 4 holes have been drilled in the bottom, seed is sown and covered and the whole tin is then placed in a hole in the ground. In due course the smaller seedlings are removed, leaving one in each tin. As soon as the seedlings are big enough for putting out, the tins are removed from the ground, and the holes at the bottom joined together, making a good space for the roots to pass through. The rolled top edge of the tin should also be cut through, because it does not rust away readily and sometimes throttles a rapid growing tree. As soon as the tins have been cut they can be planted out in the fields just as they are. Very few losses occur if this method of planting is used.

Species recommended for planting in this area are *Pinus halepensis*, *P. canariensis*, *Lagunaria patersoni*, *Olea europaea*, *Casuarina glauca*, *C. stricta*, *Eucalyptus salubris*, *E. salmonophloia*, *E. cladocalyx*, *E. cladocalyx* var. *nana*, *E. intertexta*, *E. rostrata*, *Cupressus sempervirens*, *Brachychiton populneus*, *Schinus molle*, *Tamarix aphylla*, *T. gallica*, *Acacia pycnantha*, and *Callitris robusta*.

288. ZON, R. The Volga Valley authority: the new fifteen-year conservation plan of the U.S.S.R. *Unasylya* 3 (2), 1949 (54–62).

A summary of what is known of the plan. [Cf. *For. Abstr.* 10 (pp. 442, 562).]

289. LYSENKO, T. D. Опыты посева лесных полос гнездовым способом. [Experimental sowings of shelterbelts by a patch method.] *Agrobiologiya* 1949 (1), (1–16). [Russ.] H.S.B.

In this paper, delivered at a conference of the All-Union Lenin Academy of Agricultural Sciences on November 23, 1948, Lysenko refers briefly to the vast steppe afforestation and shelterbelt project [cf. *For. Abstr.* 10 (pp. 442, 562)], the plans for which include a directive requiring extensive experiments to be made on the raising of shelterbelts by patch sowings. He stresses the necessity for relieving the young trees of competition from steppe vegetation and puts forward a scheme for direct patch sowings with agricultural intercropping for the first few years.

The belts should be laid out on well tilled land ready for sowing agricultural crops. Lines should be marked out to form series of rectangles 5 × 3 m. in size, and patches 1 m. square should be made centred on the corners of the rectangles (667 patches per ha.) and containing 5 seed spots spaced 30 cm. apart, into the bottom of which should be thrown a handful of earth from old Oak forest, since Russian experience has been that Oak seedlings that lack mycorrhizae die in their 2nd–3rd year under steppe conditions where no Oak has previously been grown. On top of this, 7–8 'pregerminated' acorns per spot (35–40 per patch) should be sown as early as possible in spring, at a depth of 5–7 cm. then covered with loose earth, lightly trodden, and a further layer of 1–2 cm. of loose earth added. The 4-m.-wide strip which remains in between is then sown with a 24-row disk seed-drill to any ordinary crop, e.g. cucurbits, potatoes, root crops, sunflower, buckwheat, or cereals. The still unoccupied rectangles of 2 × 1 m. in between the Oak patches are sown to maize or sunflower, the haulms of which are left standing after harvest to aid in snow storage. The stubble on the 4-m. strips is disked in immediately after harvesting and in autumn rye is sown together with 3 rows of *Caragana arborescens* plus other shrubs, using the 24-row seed-drill adjusted to sow the shrubs at the 6th, 12th, and 19th rows. This gives the two outer shrub rows a spacing of 152.5 cm. from the Oak lines; the inner shrub row lies at 90 cm. from one and 105 cm. from the other outer shrub row. In the spring the haulms of maize or sunflower are cleared from the 2 × 1 m. rectangles, at the centre of which a spot sowing of Norway Maple is then made. After the rye harvest, at which the stubble is left high, rye is again sown with the same drill on the

uncultivated stubble. The *Caragana* seedlings suffer little damage from the drill; at the end of the season they are pruned by the harvester cutting the rye, but will only be encouraged to branch by this treatment. Rye is then sown for the last time on the stubble and harvested when the Oak is 4 and the *Caragana* and Maple 3 years old, and the woody vegetation sufficiently dense to eliminate any competing pioneer steppe species. The temporary agricultural crops serve the dual purpose of suppressing such weeds and creating a favourable microclimate for the woody species. It is envisaged that at 30–50 years of age 1–2 Oaks and 1–2 Maples (to form an understorey) per patch should remain as the final result of natural thinning.

The reasons for sowing Oak densely in patches are given as: the natural tendency of Oak to grow in groups; quick suppression of steppe pioneers; better ability to compete with other woody species than in mixture by single trees; its capacity for self-thinning; the excellent results of dense patch sowings of Oak (up to 200 acorns per 2×2 m. patch) made by Ogievski in the Tula 'Zaseki' in the forest-steppe zone. Agreeing with the views of Kharitonovich, Lysenko devotes much space to the claim that while competition between different species is a powerful ecological factor, intra-specific competition does not exist, and attempts to trace the failure of many earlier steppe plantations to their founders' ignorance of this conception. [Cf. following abstracts and *For. Abstr.* 11 (Nos. 251–2, 769).]

290. KHARITONOVICH, F. N. Vzaimootnosheniya duba s drugimi porodami v smeshannykh nasazhdeniyakh v stepi. [Interrelationships of Oak and other species in mixed stands on the steppe.] *Agrobiologiya* 194^o (1), (17–29), 9 refs. [Russ.] H.S.B.

The author tabulates and discusses data on the growth of Oak [*Quercus robur*] in steppe plantations at Veliko-Anadol', Mariupol, and on the Kamennaya Steppe, devoting chief attention to the following mixtures:—(1) Oak + *Robinia* [*R. pseudoacacia*].—Whether in individual mixture, in alternate pure rows, or with shrubs intercalated, the *Robinia* begins to suppress the Oak with increasing severity from 5–15 years of age onwards. The Oak dies out at about 30 years and later *Robinia* itself dies. This behaviour is contrasted with the success of

Oak in mixture with shrubs (in this case *Lonicera tatarica* or *Rhus cotinus*). (2) Oak + Birch [*Betula verrucosa*].—The Birch does well on chernozems, its growth at Mariupol for the first 14 years exceeding that of *Robinia*, Common Ash [*Fraxinus excelsior*], Boxelder [*Acer negundo*] and Black Poplar [*Populus nigra*]. It has proved as dangerous a competitor of Oak as has *Robinia*. (3) Oak + Lime [*Tilia cordata*?].—Though slower at Veliko-Anadol', on the Kamennaya Steppe the Lime almost keeps pace with Oak for 5–10 years before being relegated to the lower storey. Early growth of Oak in this mixture is much the same as that of Oak with Pea-tree [*Caragana arborescens*], both mixtures being superior in the first 6 years to pure Oak. By ca. 30 years, however, closed pure Oak stands showed the best growth. (4) Oak + Ash.—Common Ash is a very dangerous competitor of Oak, the more so since after the Oak has been suppressed the open Ash crowns cannot suppress steppe plants, and the Ash later falls victim to the latter. *Fraxinus pennsylvanica*, however, is not dangerous, being suppressed by Oak from ca. 20–25 years of age. It produces valuable poles and small timber and might well be used in temporary mixture, to be removed in thinnings. (5) Oak in various mixtures with shadebearing trees—e.g. Hornbeam [*Carpinus betulus*], Lime, Norway Maple [*Acer platanoides*].—Growth of Oak in any of these is 'claimed on the evidence of some data from Veliko-Anadol' and Mariupol to be poorer than that of pure Oak or Oak plus *Caragana*, and this is put forward in support of Lysenko's theory of the non-existence of intraspecific competition.

In conclusion it is emphasized that: (a) Suitable mixtures are useful for reducing the number of Oak seeds or plants required. (b) Species such as *Robinia*, Birch, Common Ash, Elms and Boxelder, should be avoided in line mixtures, though they may be mixed in patch or group arrangements, when the larger the patches or groups, the better the results to be expected. (c) Lime, Pear [*Pyrus communis*?], Hornbeam, *Acer campestre*, and *F. pennsylvanica* are suitable trees for mixtures, but should always be separated from Oak by a shrub or row of shrubs. *A. platanoides* is also useful, provided that some help is given to the Oak in the early years by cutting away any suppressive branches of the Maple. Later the

Maple becomes a second-storey tree valuable for keeping down ground vegetation. (d) Any tree species capable of living in the steppes and competing with steppe vegetation is likely to do better in pure stands or mixed with shrubs than in mixture with other trees. The only exceptions are trees with open crowns; these must be mixed with shadebearers to suppress re-invasion by the steppe.

291. GRITSENKO, I. F. Sputniki duba v stepnykh kul'turakh: rost duba s raznyimi drevesnymi i kustarnikovymi porodami na obyknovennykh chernozemakh. [Associates of Oak in steppe plantations: the growth of Oak with various tree and shrub species on ordinary chernozems.] *Agrobiologiya* 1949 (1), (30-54). [Russ.] [Mariupol'skaya agrolesomeliiorativnaya opyt'naya stantsiya, Ol'ginka, Stalinskoy oblasti.] H.S.B.

Describes the history and the results of re-measurements in 1934, 1939 and 1946 of plantations on the Kamennaya Steppe and at Mariupol, formed respectively in 1903 and 1915 with the aim of discovering the most suitable auxiliary species for Oak [*Quercus robur*] under steppe conditions. The very similar climates and soils of the two districts are compared. Both have (1) a hot, dry summer with little precipitation, mainly in the form of heavy showers, when most of the water is lost as surface runoff; (2) severe winters with little snow and short springs during which little rain enters the soil; (3) strong E.-S.E. dry winds, often causing dust storms; (4) low relative humidities; (5) wide daily and annual ranges of air temperature, with severe early and late frosts; (6) ordinary chernozem soils, that at Mariupol being rather deeper (70-80 cm.), heavier and less leached than that of the Kamennaya Steppe (60-70 cm. deep).

On the Kamennaya Steppe the auxiliary species tried were *Fraxinus excelsior*, *Acer negundo*, *A. platanoides* and *A. tataricum*, *Betula verrucosa*, *Euonymus europaeus*, *Caragana arborescens*, *Ulmus* spp., *Lonicera tatarica*, *Pinus pallasiana*, *P. sylvestris*, *Tilia cordata* and *Pyrus* [communis?]. These were planted as 2-year stock alternating with Oak (3-year-old) in rows staggered so that each Oak had an auxiliary species on all 4 sides. The spacing was 1 x 1 m. in a N.-S. strip 106 m. wide. Apart from weeding until canopy closed (3-6 years) and some early release of Oak plants,

tending was practically confined to removal of dead trees. The Mariupol trial was planted at a spacing of 1.4 m. between and 0.65 m. in the rows, using stock with puddled roots pruned back to 20-25 cm. The arrangement adopted was Oak—shrub—auxiliary tree species—shrub—Oak. The auxiliary species were *Fraxinus excelsior*, 'American Ash' [*F. americana* or *F. pennsylvanica*?], *Acer negundo*, *A. platanoides*, *Prunus padus*, *Sorbus aucuparia*, *Pyrus* [communis?], *Pinus pallasiana*, *P. nigra* var. *calabrica* and *Robinia pseudoacacia*.

Results are tabulated and the following conclusions drawn: (1) Certain species, viz. *A. negundo*, *R. pseudoacacia*, *B. verrucosa*, *F. excelsior* and *Ulmus* spp., are clearly unsuitable in mixture with Oak, which they suppress and eventually kill out. (2) Best growth of Oak was found in mixture with shrubs, *A. platanoides*, *T. cordata*, *Pinus* spp., *Pyrus*, and in pure stands. (3) Stands of the 3 last-named types lacked a satisfactory soil-protecting understorey. *Pinus* and *Pyrus* eventually died out, leaving pure Oak which developed epicormics and showed poor natural pruning. This condition of the Oak also occurred where only a shrub understorey was provided. (4) The only stands which did not show these defects were those where *A. platanoides* or *Tilia cordata* had been admixed, and in these the growth equalled that of natural stands of the first quality class. These two species are therefore those needed. 'American Ash' may also be used and is a valuable species.

292. PRYAKHIN, I. P., and PORTNYKH, YU. P. O kulture duba ploshchadkami dlya polezashchitnykh nasazhdeni. [Patch methods of raising Oak for shelterbelts.] *Agrobiologiya* 1949 (1), (75-84). [Russ.] [Zapovednik 'Tul'skie zaseki', Krapivna, Tul'skoy oblasti.] H.S.B.

In the spring of 1911 Prof. Ogievski made trials of dense line and patch direct sowings of pure Oak in the Tula 'Zaseki' in the forest-steppe zone, on a felling site of the previous year with uniform soil (medium podzolized loess clay-loam). The lines and patches were both spaced 4.5 m. apart. In the former 10 acorns per m. were sown; of the latter, each had an area of 2 sq.m. sown with 50 acorns (20,000 acorns/ha. in both cases). The aims of the patch sowings were to have 1 Oak per patch at maturity, to secure uniform distribution and

growth of the Oak, to enhance suppression of ground vegetation and resistance to unfavourable climatic conditions, and to use Oak in the dual role of auxiliary and main species, taking advantage of natural selection by self-thinning. Neither of the stands was tended, apart from the removal of some of the dead trees. The seed used was of 3 different origins, sown in alternate lines and alternate rows of patches.

Results of measurements at 37 years of age are tabulated and discussed. The number of Oak stems per ha. in the patch sowings (A) was twice that in the line sowings (B). Oak in (A) had a slightly higher mean diameter, and slightly lower mean height (presumably due to greater natural invasion by other hardwoods in (B)), was healthier and of better quality, and had a volume 234% of that in (B). (A) showed greater resistance to invasion by other hardwoods than (B), where natural Aspen and Birch, in particular, formed a significant part of the stand. In view of these favourable results, the method is recommended for wider application both in the forest and for afforestation and shelterbelt work. In shelterbelt plantings closer spacing of the patches (e.g. 600/ha. as compared with 200/ha. in the forest) would be necessary. The intervals between patches should be devoted to temporary agricultural use or stocked with associates of Oak, e.g. Lime, Elm, Ash and Maple, plus fruit- and berry-bearing drought-resistant species. Hazel is worth particular trial among the latter. Where fast-growing species are used in mixture it will be essential to eliminate them by thinning or girdling before they suppress the Oak.

293. YURRE, N. A. Sozdanie polezashchitnykh polos gnezdvymi posevami i posadkami. [Formation of shelterbelts by patch sowings and plantings.] *Agrobiologiya* 1949 (1), (85-91). 2 refs. [Russ.] [Sluzhba puti Azerbaydzhanskoy zheleznoy dorogi, Otdel zhivoy zashchity, Baku.] H.S.B.

Late closure of canopy, necessitating 4-6 years of expensive weed control by soil cultivation, is the chief drawback of row planting of trees and shrubs plus a small admixture of fruit trees—hitherto the usual method of forming shelterbelts. This method delays the time when the belt becomes effective and thinnings produce comparatively little of the wood so badly needed in the steppe regions. Direct sowing in lines has rarely been used and also

necessitates soil cultivation for the first few years. The method of densely sown patches avoids these difficulties: canopy closes usually in the first year; height growth is quicker and the belt becomes effective at the earliest possible date. The species used should be tall, resistant [to frost and drought], long-lived, and should have rapid canopy formation, good natural regeneration from coppice or seed, and should encourage the nesting of useful birds. So long as no competition from other species is likely to develop within the patches or from near neighbours, the author's view is that mixtures of different species are desirable but that is best obtained by the alternation of pure patches of different species. On the basis of his long experience in silvicultural research, he puts forward two methods of patch sowing for the steppe and forest-steppe zones on chernozems, suitable also for other regions where shelterbelts are grown if the choice of species is modified accordingly: (1) *For the plains*:—Patches 2×1 m. in size, in 5 rows, spaced (centre to centre) 3 m. between and 2 m. in the rows (1,665/ha.). Principal species Oak [*Quercus robur*] (30%); subsidiary species *Acer platanoides* and 'American Ash' [*Fraxinus americana* or *F. pennsylvanica*?] (40%) and shrubs (30%). First row—alternate patches of Oak and shrubs; 2nd—alternate Ash and Maple; 3rd—alternate Oak and shrubs, etc. Acorns are sown singly at 25×25 cm. spacing, and the soil inoculated if Oak is being grown for the first time. The remaining species are sown in criss-cross drills forming a pattern of 25 cm. squares. The seed required in g. per m. of drill (total length 19 m. per patch) being: Ash 1.5, Maple 2, *Caragana arborescens* 1. All seed must be first-grade and physiologically ripe. Sowing is done in spring, when the Ash and Maple seed must have been stratified; these two species can be autumn sown, but Oak and *Caragana* must be sown in spring. In the first season 1-2 weedings must be done in the patches, and 1-2 cultivations with a horse cultivator between them. From the 4th to 5th years onwards, removal of wolf trees may be necessary. Later tendings will be those usual for shelterbelts. If planting is used, plants should be spaced 50×50 cm. (15 per patch) and should be standard 1-grade stock, 1-year-old for Oak, and *Caragana* and 2-year-old for Maple. Mycorrhizal Oak stock is essential. (2) *For areas where erosion occurs*:—Belts in such

regions must be wider and must follow the contours. Patches should be 2×2 m. in size, in 9 rows spaced (centre to centre) 3 m. between and 3 m. in the rows (1,011/ha.) and staggered. Principal species Oak (17%); subsidiary species *Acer platanoides* and 'American Ash' (44%) *Elaeagnus angustifolia* and *Caragana arborescens* (39%). First and 9th rows—*Elaeagnus*; 2nd—alternate Ash and Maple; 3rd—alternate Oak and *Caragana*; 4th—alternate Ash and Maple, etc. Acorns and other seed sown, or planting done, at the same spacings as under (1). If faster growing species, e.g. 'Canadian' Poplar or *Acer negundo*, are used, the spacings (centre to centre) must be increased to $3.5-4 \times 2.5-3$ m. for (1) and $3.5-4$ m. square for (2).

294. LABUNSKI, I. M. Les—moguchee sredstvo peredelki prirodny stepey. [The forest—a mighty instrument for transforming nature in the steppes.] *Agrobiologiya* 1949 (1), (102-14). 6 refs. [Russ.] [Lesoplytnaya stantsiya Ol'ginka, Stalinskoy oblasti.] H.S.B.

Summarizes the earlier history of the Veliko-Anadol' plantations, Stalingrad Province, and their effects on the water table to the year 1947. In the earliest plantations, dating from 1843, only Oak was not a failure and was recommended by a scientific committee in 1891 as the principal species for steppe plantations. Dokuchaev's expedition in 1892, to study means of combating drought, was followed by the establishment of 3 research stations, of which one was at Veliko-Anadol'. Work by Vysotski showed the unsuitability of Elms and the value of shrubs in mixture with Oak, and Dakhnov's 1894 plantations of Oak in mixture with *Acer platanoides* and *Tilia [cordata?]* were extremely successful, thus demonstrating that the key to steppe afforestation is choice of species. Mixtures by pure groups have been especially successful and the larger the number of individuals of the same species in a group, the more resistant have been the groups, and consequently the stands, to steppe conditions. Although most of the stands were planted, the minority that were sown—particularly where the Oak patches were densely sown—have given the best results.

In 1893 Prof. Zemyatchenski made a series of borings in the Veliko-Anadol' area. Ground-water levels as revealed by these and borings in the same months on the same sites in 1946 and 1947 are compared in a table [without, however,

indicating the exact location of the borings]. These show rises of the water table since 1893 varying from 0.2 to over 5 m. for which no other reason can be found than the successful mixed plantations raised by Dakhnov. Literature on the district is cited in evidence of striking rises of the water table in and around the forest plantations, as are also 1946-7 data indicating similar rises in wells sunk by Vysotski. Springs and constant streams have made their appearance round the catchment and, on adjacent farm land, crop yields have been superior to those elsewhere on the open steppe, particularly in the drought year of 1946. These effects are ascribed to prevention of surface run-off and soil blowing, lower evaporation from the soil in the forest, and greatly improved subsoil conditions as regards water penetration and storage, owing to the formation of crevices by tree roots.

295. BASOV, G. F. Gidrologicheskaya rol' lesnykh polos Kamennoy Stepi. [The hydrological role of shelter belts on the Kamennaya Steppe.] *Agrobiologiya* 1949 (1), (131-47). [Russ.] [Institut zemledeliya im. V.V. Dokuchaeva, Talovaya, Voronezhskoy oblasti.] H.S.B.

Describes the location of the shelterbelts, with an account of the climate and geology of the district, and summarizes the results of hydrological research there from the studies of Dokuchaev and others in 1892-8, begun when the area was still steppe, and those—chiefly in 1939-47—of the Soviet period.

Dokuchaev's 2 observation wells and 2 open catchments have grown to a large hydrological station with 70 wells and embracing 5 catchments. Meteorological data are briefly reviewed to indicate reductions in evaporation and wind velocity within the system of belts.

(1) *Surface run-off*: The coefficients of [spring?] run-off from open steppe and field catchments have remained practically constant (0.724 for 1892-5; 0.536-0.600 for 1933-47). Data for 'forested' and open catchments are tabulated and discussed, with the conclusion that the presence of tree growth has reduced surface run-off 1.5-1.8 times in catchments with trees only at the top, 1.65-2.3 times in those with 6% and 4 times in those with 18% of their area under trees. In the last case run-off in some years has been nil.

(2) *Infiltration*: Observations of run-off on 4

plots—2 in the fields just above and 2 in those just below a shelterbelt 45 m. wide—showed that the water absorbed [in spring?] per sq. m. in the belt averaged 20 times (12–50 times) that of the fields. Only after warm winters, however, was the soil of the belt able to absorb all the surface flow, and 45 m. must be regarded as the minimum width for such belts spaced ca: 400 m. apart on slopes.

(3) *Ground water*: Data on seasonal and long-term variations in the water table are discussed. Seasonal variations indicate that rainfall penetrates every year to the water table, chiefly in the spring snow-melting period, in long spells of autumn rain, and during winter thaws. Of these the spring snowmelt contributes the most to underground water reserves. The long-term variations appear to show a 10- to 14-year interval between maxima and minima and run parallel to the variations in level of the Caspian Sea. The influence of shelterbelts on the height of the water table shows variations with width of belt and season. In dry periods the water table below the belt is lowered to an extent dependent upon the width of the belt, e.g. in the drought year 1939 this lowering [period not stated] varied from 30 cm. for a 210 m.-wide to 3.4 cm. for a 33 m.-wide belt. The effect normally appears in the second half of the vegetative period, attains its maximum in September, and disappears towards November. The spring rise of the water table, on the other hand, has averaged 1.48 m. under the shelterbelts, 1.43 at their margins, 0.833 in the fields between and only 0.625 in the open steppe. The question whether the belts accumulate water to the benefit of the adjacent land is examined on the basis of special observations of the water table (the height of which is given in absolute figures as m. above sea level), from 1939–46, in a profile (illustrated) sloping gently down from open steppe through a series of shelterbelts of various widths and variously spaced. The winter profile of January 1941 has a water table gradually falling from the open steppe to the 2nd shelterbelt and then more steeply towards the foot of the slope, occupied by fields and further belts. On March 24 the water table had scarcely risen in the steppe, 400 m. distant from the first belt, which traps the most snow, but under the latter it was 3 m. higher, and there were slight rises under the fields and belts farther down the slope. In 1940 this 'hump' of ground water beneath the

first belt persisted for 4 months till August 10. A table gives the duration of this effect (1 to 9 months) in 3 different profiles for 1940–3 and 1946. The water thus accumulated will feed the adjacent steppe and fields for a considerable part of the growing season. From long-term observations on ground water it is calculated that snow melting and early rain contribute 725 cu.m. water/ha. to the steppe ground water and 1,043 to that in the shelterbelt zone. Besides this, some 530 cu.m./ha. is ordinarily retained as soil moisture in the steppe as compared with 815 in the shelterbelt zone. Figures from meteorological and run-off data, said to be less exact, are lower but show the same trend and are not too divergent in magnitude. On the whole, the ground water of the shelterbelt zone must receive 400–600 cu.m./ha. more than that of the open steppe. In conclusion the water tables of the area in its original condition of steppe are compared with those of to-day—(a) as the average level at September 1 for 1892–6 and 1942–6 (+ 1.31 m.); (b) as the means of the yearly averages for 1893–8 and 1943–7 (+ 0.86 m.; and (c) as at September 1 of 1892 and 1946 (+ 1.70 m.).

296. BURNATSKI, D. P., and SUCHALKINA, M. I. Vodny rezhim pochv Kamennoy Stepi v zasushlivye gody. [The water régime of soils in the Kamennaya Steppe in drought years.] *Agrobiologiya* 1949 (1), (148–60). [Russ.] [Institut zemledeliya im. V.V. Dokuchaeva, Talovaya, Voronezhskoye blasti.] H.S.B.

This paper is chiefly concerned with a comparison of soil moisture in the growing seasons of 1946 and 1947 (a) in fields worked on a ley system, either bordered by shelterbelts or in the open steppe, and (b) in steppe farmland without a grass ley and with no definite rotation of crops. So far as shelterbelt influences are concerned, it is shown that the soil drought existing elsewhere was practically absent from fields between the belts and the generally much higher soil moisture of the latter resulted in better crop yields. These fields stored a higher proportion of the winter precipitation than those outside the system of belts. Data for soil moisture in the 0–30 and 0–100 cm. layers under various crops in the different situations, are tabulated for each of the months April–September 1947.

297. SOBOLEV, S. S. Bor'ba s eroziyey pochv na osnove travopol'noy sistem' zemledeliya. [Erosion control on the basis of the ley system of agriculture.] *Pedology* 1949 (1), (18-27). 26 refs. [Russ.] A.C.P.

A section of this paper, written in connexion with the present vast scheme for the amelioration of the steppes, is devoted to shelterbelts and afforestation. A report in *Pravda* is quoted which states that on the borders of the Kulundinsk Steppe, observations by the Lebyazhinsk forestry station have shown that the dry winds from Kazakhstan double their humidity in passing over the extensive ribbon-like strips of Pine forest in this region, and the amount of summer rainfall is 30-50 mm. greater than in the steppe. Studies in the Kammenaya steppe are briefly mentioned, with a report that in March-April and in December 1946, the crops protected by shelterbelts escaped damage from dust storms, whereas 60-80% of those in open country were damaged.

The new scheme recognizes that different localities and particularly different types of relief may require anything from ordinary narrow shelterbelts to blocks of forest. Diagrams are included of 6 broad types of relief and the types and arrangement of tree plantations suited to them; e.g. for protection against dry winds on flat land, belts 10-20 m. wide are required; for slopes, where both wind and erosion are to be controlled, belts 20-60 m. wide; for brows of steep valleys and ravines, belts 20-50 m. wide; and for ravine sides etc., actual woods. Spacing of belts will vary with gradient. River bank protection and training with the aid of living barricades of Poplar and Willows are also envisaged.

24.5. Pruning

See also *For. Abstr.* 11 (Nos. 276, 709).

298. MUNGER, T. T., and KACHIN, T. Multiple-spur climbers for high pruning. *J. For.* 47 (5), 1949 (373-7).

Pruning above the level of pole saws and ladders is desirable in young Douglas Fir, but climbing with the conventional single-spur climbing iron does considerable damage. To minimize this damage, the authors invented a climbing iron with several short points set on a curve to fit the tree instead of the single long point. In tests made in the field, most climbers felt as safe with one as with the other.

They reported less fatigue to feet and ankles with the multiple-spur type, because of the increased plane of grip. The short spurs do not penetrate the thick bark of Douglas Fir to reach the cambium. No kind of climbing spur should be used on thin-barked species such as Sitka Spruce and Western Hemlock.

299. Ett nytt skogsredskap. [A new forestry tool.] *Skogen* 35 (23), 1948 (272). [Sw.]

The Kvistex, a push-type pruning tool devised by K. Weigl, Kalix, consists of a metal mounting shaped like a Y, with a tubular stem to fit the end of a pole and flat arms (set in a plane at a slight angle to the axis of the pole) to which are bolted blunt-tipped knives forming a V-shaped cutter. The knives are detached for sharpening. A skilled worker can prune $\frac{3}{4}$ -in. branches, clean and flush to the stem, with a single short, brisk movement. The tool is handy, and considerably reduces the risk of damage to the stem. The model so far available is designed for stems of 4 in. and more in diameter.

300. ROWLAND, C. A., JR. Bud-pruning for better logs. *Sth. Lumberm.* 177 (2225), 1948 (142-3). [Southeastern Forest Experiment Station.]

In 1947 a number of plots were established in Slash Pine [*Pinus caribaea*] plantations near Athens, Georgia, to study the cost of bud-pruning and its effect on growth, quality of logs produced and on the stand [cf. *For. Abstr.* 8 (Nos. 1072-3)]. The trees, averaging 3-5 ft. in height, were 3-4 years old, and spaced 6 x 6 ft. Every other tree in alternate rows was pruned, and, in half the plots, all unpruned trees were removed. In addition to the bud-pruning, which was delayed till the buds were swelling, the limbs which form along the main stem in Southern Pines were also clipped off. After one year both pruned and unpruned trees had made equal growth in height and diameter. Average pruning time to clear a 16-ft. length in the first two treatments was only about 5 man-minutes—somewhat less than the conventional methods require. There was evidence that bud-pruned trees are more resistant to ice damage during the first year after pruning.

301. Pruning [of *Pinus radiata*]. *Rep. For. Timb. Bur. Aust.* 1947, 1948 (16).

Experiments have shown that in medium- and high-quality plantations spaced 8×8 ft. and 9×9 ft., it is possible by pruning to confine the knotty core to 6—7 in. in diameter on the average dominant tree, with little or no effect on the tree's increment. It is, however, necessary to begin such pruning at 5–6 years of age on the high-quality sites to achieve this result. On low-quality sites, knotty cores can be restricted to diameters an inch smaller, without reducing the rate of growth. Pruning has been shown to reduce the taper of the pruned zone. The increment of green-pruned trees is reduced when surrounded by unpruned trees.

27. TREATMENT OF EXCESSIVELY OPEN STANDS

302. TAYLOR, SIR W. L. **The re-afforestation of devastated areas.** *British*

agricultural Bulletin, London 1 (3), 1948 (102–6). O.R.E.

A discussion of regeneration problems in post-war Britain.

303. METZ-NOBLAT, H. DE. La reconstitution d'une forêt ruinée par une exploitation abusive. [**The restoration of a forest ruined by excessive exploitation.**] *Action for. pisc.* No. 141, 1949 (1–2). [F.]

The author describes a derelict forest, formerly managed as coppice with standards, and over-exploited during the 1914–8 war, when all trees of 20 cm. diameter and over were felled, and all coppice growth of 15 years and over clear felled. This is in process of conversion to uneven-aged high forest suitable for management under a full selection system. The various steps in the process are described.

3. FOREST UTILIZATION. FOREST TECHNOLOGY

304. La fondation de la Commission Internationale d'Utilisation du Bois du Centre International de Sylviculture. [The foundation of the International Commission on Wood Utilization of the International Forestry Centre (C.I.S.).] *Silvae Orbis* Nos. 8, 1943, pp. 118 [G.]; 8a, 1943, pp. 126. [F.]

Includes the following papers delivered at the foundation session:—International collaboration in the field of wood utilization (J. Köstler); The statutes and organization of the Commission (G. Golay); The development and organization of wood research in Germany (F. Kollmann); The chief problems of rationalization in the field of wood utilization in Bulgaria (G. Sirakow); Wood research in Finland (M. Lévon); The organization of wood utilization research in France (J. Campredon); Wood research in Italy (G. Sala); Organization and results of wood research in Sweden (E. Hägglund); Wood research in Switzerland (H. G. Winkelmann).

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

31.0. General Information on Woods

See also *For. Abstr.* 11 (Nos. 33, 182–3).

305. [JAY, A.] These new woods have graduated. *Timb. & Plyw.* 96 (2490), 1949 (x). P.R.

Summary of a T.D.A. lecture on new tropical timbers imported into Great Britain, with a list of 25 timbers, grouped by weight, indicating suitable uses for them.

306. Nomenclature des principales essences forestières utilisées en Belgique. Namenlijst der voornaamste in België gebruikte houtsoorten. [Nomenclature of the principal species of timber used in Belgium.] Febelbois, 57 Rue d'Arlon, Bruxelles. 1946. pp. 115 + 2. [F.Flem.]

Gives Flemish, French and English vernacular names, together with density, colour and principal uses.

307. SUKASVASTI, PRINCE. [Useful timbers and forest products of Siam.] Royal

Forest Department, Bangkok. Revised, 1942. pp. 451 + 197. [Siam.] P.R.

A classification of timbers according to their uses (including plywood and wood pulp); lists of fibre-yielding plants, with their uses; of trees yielding various minor forest products; and of the trade and botanical names of some Siamese species. Tables (with Siamese and English captions) give the mechanical properties (moisture content, specific gravity, bending, compression, shear and tensile strengths, hardness and cleavage moment) of 54 species. There are indexes in English and Siamese.

308. Canadian export timbers: their properties and uses. Department of Trade and Commerce, and Forest Products Laboratories, Department of Mines and Resources, Ottawa. 1948. pp. 71. Price 25 cents. P.R.

309. FANSHAWE, D. B. Forest products of British Guiana. Part 1. Principal timbers. *For. Bull. For. Dep. Brit. Guiana* No. 1, 1948. pp. 60 + 4 + 1 tbl. 29 refs.

Includes vernacular and botanical names, description of the timbers and tables showing frequency of the species in different areas and a tentative classification of timbers by their uses.

310. Specimen woods Nos. 159–61. *Suppls. to Wood* 14 (3–5), 1949 (83–4; 115–6; 147–8).

Kokrodua (*Afrormosia elata*), Ogea (*Daniella ogea*), and Chilean Laurel (*Laurelia aromatica*).

311. LAMB, G. N. Foreign woods—origin, use, properties and nomenclature. *Wood Prod.* 54 (3; 5), 1949 (26; 28, 30).

(a) Greenheart (*Ocotea rodiaei*), Caracoli (*Bucida buceras*) and Massaranduba (*Mimusops huberi*).

(b) Lignum Vitae (*Guaiaecum officinale*), Snakewood (*Piratinera guianensis*), Satinwood (*Chloroxylon swietenia*), and Manglillo (*Ternstroemia* sp.).

312. [French colonial timbers.] *Bois For. Trop.* No. 9, 1949 (63–74). [F.]

Limbo (*Terminalia superba*), Tali (*Erythrophleum guineense* and *E. micranthum*), and Zingana (*Microberlinia brazzavillensis*).

313. COOK, D. B., and SIMS, I. H. **Beech utilization and management problems.** *For. Chron.* 25 (1), 1949 (15-20).

A short account of the silvicultural characters and wood properties of American Beech [*Fagus grandifolia*], its possible uses, and means of overcoming the difficulties of seasoning which have hitherto made it unpopular with the timber trade. It is essential that Beech lumber should be delivered direct from the saw to the kiln so that it does not warp or check. Thick turning squares can be seasoned if, as they come from the saw, the ends are dipped in paraffin, and the squares closely piled in a tight shed with just enough ventilation to prevent moulding.

314. SUSMEL, L. Nota sulle proprietà del legno de *Lyriodendron* in rapporto al clima. [Note on the characters of *Liriodendron tulipifera* in relation to climate.] *Ital. for. mont.* 4 (2), 1949 (94-9). [It.]

An account of the silvicultural and wood characteristics of *Liriodendron tulipifera*, and its suitability for planting in Italy. Nine 60-year-old specimens measured at Vallombrosa had annual rings of 2-5 mm. (average 3.1-3.3) in width, or much the same as the values for the U.S.A.; d.b.h. outside bark, 38-41 cm.; height 20-23 m.

315. TIAMA: fiche botanique, forestière, industrielle et commerciale. [Botanical, silvicultural, industrial and commercial notes on *Gedu Nphor* [*Entandophragma angolense*].] *Bois For. Trop.* No. 8, 1948 (395-8). [F.]

316. MURRAY, D. E. ***Eucalyptus* forests in Australia [the species and their uses].** *Wood* 14 (3), 1949 (71-3).

317. ORMAN, H. R. **Teak grown in Western Samoa.** *N.Z. J. For.* 5 (5), 1948 (1949), (430-4).

Includes a comparison of mechanical and physical properties of green Teak from Samoa and Burma.

31.1. Structure. Anatomy. Identification

See also *For. Abstr.* 11
(Nos. 71, 124, 201-2, 358, 363-4).

318. BERKLEY, E. E., and WOODYARD, O. C. **Certain variations in the structure of**

wood fibers. *Textile. Research Journal, Lancaster, Pa.* 18 (9), 1948 (519-25). 3 refs. L.S.

X-ray diffraction patterns were obtained from the fibres of *Sequoia*, *Trochodendron*, *Taxodium* root, *Pinus palustris* and *P. ponderosa* compression wood, and are reproduced in photographs. The patterns obtained from *Trochodendron* are interpreted as showing that the main part of the crystalline cellulose lies more or less parallel with, or at a small angle to, the long axis of the fibre. The patterns from *Sequoia* are interpreted as showing at least 3 spirals. Those from *Taxodium* root also show more than one spiral. Those from the *Pinus* sample show a more or less random arrangement. The patterns obtained by passing the X-ray beam parallel with the long axes of the fibres are difficult to interpret.

319. PRESTON, R. D. **The fine structure of the wall of the conifer tracheid. III. Dimensional relationships in the central layer of the secondary wall.** *Repr. from Biochimica et Biophysica Acta* No. 2, 1948 (370-83). 15 refs. [E.e.f.g.]

Cf. *For. Abstr.* 9 (Nos. 286, 287).

320. GEROLA, F. M. La differenziazione degli elementi legnosi nel caule. [The differentiation of the woody elements in the stem [of a tree].] *Nuovo G. bot. ital. (n.s.)* 53 (1/2), 1946 (76-128). 26 refs. [It.] O.B.D.

Studies the causes determining the formation of xylem in plants. The indispensable factors for the production of normal wood are set forth, and the nature and method of diffusion of the stimulus for differentiation of tissue are examined. Traumatic tracheids and traumatic wood are distinguished from normal wood. The function of organizing centre is attributed to the meristem.

321. MÜLLER-STOLL, W. R. Photometrische Holzstruktur-Untersuchungen. I. Mitteilung: Über die Ermittlung von Jahringaufbau und Spätholzanteil auf photometrischem Wege. [Photometric investigations of wood structure. Part I: The determination of annual ring structure and the proportion of late wood by photometric methods.] *Planta* 35 (3/4), 1947 (397-426). 12 refs. [G.g.] O.B.D.

The boundary between late and early wood

can be determined with accuracy by a photometric method, which is described. By the use of microfilm projections of thin cross-sections, the width of annual rings can be measured, values for light penetration through the wood can be obtained, and the composition of the rings in early and late wood plotted. It was ascertained that the late-wood boundary is at the centre of gravity of the annual ring. Some correction factors for different moisture contents in a few species are included.

322. MESSERI, A. L'evoluzione della cerchia legnosa in *Pinus halepensis* Mill. in Bari (dal Luglio 1946 al Luglio 1947). [The development of the annual ring in *Pinus halepensis* at Bari (July 1946-July 1947).] *Nuovo G. bot. ital. (n.s.)* 55 (1), 1948 (111-32 + 8 photos). 7 refs. [It.it.e.] O.B.D.

A study of the anatomical characters of the annual ring in Aleppo Pine (1) in a mature tree (80-100 years old) and (2) in a young one (20-25 years old). In each case a young branch, as well as the trunk, was investigated. Differentiation between early and late wood was more marked in the older than in the younger tree, and in the trunk than in the branches. In all cases the cambium initiates its radial growth about one month before the vegetative buds begin to open. Early wood is found from April to June; differentiation of late wood takes place in July.

323. NOBILE, M. T. Richerche sulla istologia del legno secondario delle Gymnospermae. VIII. Studio istologico del legno secondario di *Pinus halepensis* Mill. [Studies in the histology of the secondary wood of the Gymnosperms. VIII. *Pinus halepensis*.] *Nuovo G. bot. ital. (n.s.)* 54 (3/4), 1947 (484-93). 7 refs. [It.it.e.] O.B.D.

The wood of Aleppo Pine was found not to differ strikingly from that of conifers already investigated. The tracheids display a distinct dimorphism, elements being either predominantly conductive or predominantly mechanical, in both early and late wood, the conductive tracheids being on the whole shorter than the mechanical. The diagrams and graphs are explained in English.

324. GIAQUILI-FERRINI, G. F. Ricerche sulla istologia del legno secondario delle Gymnospermae. V. Studio istologico del legno secondario di *Juniperus foetidissima* Willd.

[Studies in the histology of the secondary wood of Gymnosperms. V. *Juniperus foetidissima*.] *Nuovo G. bot. ital. (n.s.)* 49 (3/4), 1942 (415-9). [It.] O.B.D.

325. PROFILI, V. Ricerche sulla istologia del legno secondario delle Gymnospermae. VI. Studio istologico del legno secondario di *Juniperus oxycedrus* L. [Studies in the histology of the secondary wood of Gymnosperms. VI. *Juniperus oxycedrus*.] *Nuovo G. bot. ital. (n.s.)* 49 (3/4), 1942 (420-3). [It.] O.B.D.

326. CIAMPI, C. Ricerche sulla istologia del legno secondario delle Gymnospermae. VII. Studio istologico del legno secondario di *Juniperus chinensis* L. [Studies in the histology of the secondary wood of Gymnosperms. VII. *Juniperus chinensis*.] *Nuovo G. bot. ital. (n.s.)* 49 (3/4), 1942 (424-6). [It.] O.B.D.

327. NORMAND, D. Note sur les bois de *Dacryodes* et de *Santiria* africains. [A note on timbers of African species of *Dacryodes* and *Santiria*.] *Bois For. Trop.* No. 8, 1948 (399-402). [F.]

Cf. *For. Abstr.* 11 (No. 157).

328. OCCHIONI, A., and LYRA, M. E. M. DE Contribuição ao estudo das Monimiaceae medicinais brasileiras. [Contribution to the study of the medicinal Monimiaceae of Brazil.] *Arquivos do Jardim botânico do Rio de Janeiro* 8, 1948 (253-73). 11 refs. P.R.

A histological, anatomical and chemical study of *Siparuna apiosyce*.

329. CHATTAWAY, M. M. The wood anatomy of the Proteaceae. *Repr. from Aust. J. sci. Res.* 1B (3), 1948 (279-302 + 40 photos). 14 refs. (*Repr. For. Prod. Aust.* No. 108).

The wood anatomy and geographical distribution of 26 genera of the Proteaceae are described. Only those genera producing timber trees or large woody shrubs are dealt with. The wood anatomy is discussed (a) in relation to botanical classification, with special reference to those genera having marked intra-generic differences, and (b) in relation to that of other woods with large rays, detailing the means of distinguishing them. *From author's summary.*

31.2. Physical Properties

31.21. Conductivity

See also *For. Abstr.* 11 (Nos. 367, 551).

330. PETERSON, R. W. **The dielectric properties of wood.** *B.C. Lumberm.* 33 (3), 1949 (99-100).

In a study of Canadian woods at the Forest Products Laboratory, Ottawa, the relationship between moisture content and dielectric properties was investigated. Yellow Birch [*Betula lutea*] and Douglas Fir were mainly studied, but some work was also done on White Spruce [*Picea glauca*] and Sugar Maple [*Acer saccharum*]. Specimens were tested at moisture contents ranging from oven-dry to 20%. All measurements were made at a temperature of $80^{\circ}\text{F.} \pm 10^{\circ}$ and at a frequency of 5 megacycles. The results, which are plotted, show a definite relationship between dielectric constant and density, the dielectric constant increasing with density, regardless of species. The same relationship does not appear to hold true for the power factor, for considerable variation was observed in the values obtained for the dielectric properties of any one species, particularly at the higher moisture contents.

331. SKAAR, C. **The dielectrical properties of wood at several radio frequencies.** *Tech. Publ. N.Y. St. Coll. For.* No. 69, 1948. pp. 36. 10 refs.

Sample specimens of varying moisture content of 30 commercial timbers were measured to determine their perpendicular-to-the-grain dielectric properties, power factors and resistivities at different frequencies. The results, which are shown in graphs, indicate that: (1) the dielectric constant increases with increase of density and moisture content, and decreases with increase of frequency; (2) the power factor increases with the moisture content at a given frequency; at moisture contents below 15% it increases with the frequency, but at higher moisture contents the reverse is the case. A weak positive correlation exists between the power factor and wood density; (3) the resistivity decreases as moisture content increases, and is greater at lower than at higher frequencies; a relatively strong negative correlation exists between resistivity and density. The parallel-to-grain dielectric constant is 30-50% higher, power factor about twice, and

resistivity half the corresponding perpendicular-to-grain values. These results appear to be true for all species examined.

31.22. Relation to Water, Air, Gases

332. **The moisture content of living trees.** *Rep. For. Timb. Bur. Aust.* 1947, 1948 (13).

Measurements made of the moisture content of living Eucalypt trees showed that although the lateral distribution of moisture within the trunk varies with individuals of the same species, it frequently appears to be high in the centre of the tree and in the outer layers of the trunk, with a drier region between these two zones. The vertical distribution of moisture was found to vary greatly.

333. PILLOW, M. Y. **Variations in longitudinal shrinkage of second-growth Douglas-Fir.** *J. For.* 47 (5), 1949 (383-91). 6 refs.

The author's studies of longitudinal shrinkage in Douglas Fir showed it normally to be about the same in second-growth as in old-growth timber. The data showed a general trend of increasing longitudinal shrinkage related to increases in the number of rings per inch and percentages of summerwood, although specimens with only summerwood had lower shrinkage than those with only springwood. Further investigations are necessary to determine the relationships of growth and structure to longitudinal shrinkage of second-growth Douglas Fir, that result in exceptionally high longitudinal shrinkage near the pith of some rapid-growth trees, as compared with others with low shrinkage and even with elongation.

334. ERICKSON, H. D. **Relation of specific gravity to shrinkage and of these factors to growth in Yellow Poplar.** *J. agric. Res.* 78 (5/6), 1949 (103-27). 7 refs. O.R.E.

Some of the physical properties of Yellow Poplar [*Liriodendron tulipifera*] (age 86 to 273 years) and some of the factors that might influence these properties, were studied from samples taken from 23 trees on a 200-acre tract in W. Virginia. Statistical analyses were used to evaluate these relationships and to indicate

the interacting factors. Findings included the following:—

The specific gravity varied inversely with the number of rings per in. but the correlation coefficient was small.

An inverse relationship was obtained between number of rings per in. and shrinkage—volumetric, tangential, or radial. Volumetric shrinkage increased as specific gravity increased.

Age was found to have some effect on specific gravity, especially in the blocks of 20 rings per in. or less. However, these results are not considered conclusive.

Wood near the pith was lower in specific gravity, radial shrinkage and longitudinal shrinkage, than wood farther out; in volumetric shrinkage there was little difference.

When the rate of growth changed in a tree there was usually an accompanying change in specific gravity, although the amount of change in specific gravity was quite variable. When the tree resumed its former rate of growth, specific gravity tended to return to its former value.

No difference in specific gravity was found between the north and south sides of the tree. There was some evidence that the side of shorter radius was more likely to have a higher average specific gravity than the opposite side.

The average shrinkage values, excluding wood near the pith, were: volumetric 11.92%, tangential 7.67%, radial 4.20%, and longitudinal 0.20%. The average rate of growth was 16 rings per in.

The average longitudinal shrinkage was generally greater in wood from the side of the lower specific gravity, whether the wood was from the north or the south side of the tree. Likewise, wood from the side of longer radius usually showed a greater average longitudinal shrinkage than wood from the side of shorter radius.

Except in wood near the pith, no important difference was found between the specific gravity of sapwood and heartwood.

31.23. Weight. Specific Gravity

See also *For. Abstr.* 11 (No. 334).

335. SCOTT, M. H. **Weights of timbers used in South Africa, with a list of their standard and common names.** *J. S. Afr. For. Ass.* No. 17, 1949 (75–112).

336. **Density of wood of *Pinus radiata*.** *Rep. For. Timb. Bur. Aust.* 1947, 1948 (13).

An investigation of the density of the wood of trees that have been stayed against sway at some height from the ground, showed that it was less than that of unstayed trees.

31.25. Hardness

337. WEATHERWAX, R. C., ERICKSON, E. C. O., and STAMM, A. J. **A means of determining the hardness of wood and modified woods over a broad specific gravity.** *Bull. Amer. Soc. Test. Mater.* No. 153, 1948 (84–9). 17 refs. [U.S. Forest Products Laboratory, Madison.] P.R.

Describes a modified A.S.T.M. hardness test developed for woods ranging in specific gravity from Balsa at 0.07 to Compreg and Staypak at 1.4. Results are given in graphs and tables and from these, equations are obtained for the hardness modulus expressed in terms of specific gravity. Resin treatment increases the hardness modulus by 14–24%. The modulus of hardness per unit weight is greater for Compreg and Staypak than for sulphur- and metal-treated woods. *From author's summary.*

31.27. Mechanical Strength

See also *For. Abstr.* 11

(Nos. 421–2, 428, 430–1, 483, 619).

338. SILVERSIDES, C. R. **The application of SR-4 strain gauges in woods operations in Eastern Canada.** *Woodl. Res. Index Canad. Pulp. Pap. Ass.* No. 51 (B-1), 1949. pp. 7. 6 refs.

The SR-4 strain gauge is based on the principle that if a wire conducting electricity is placed under tension or compression, there will be a change in the cross-sectional area of the wire and an accompanying change in the wire's resistance to the electrical current. The gauge, which is only $\frac{3}{8} \times \frac{7}{8} \times 0.01$ in. in size and weighs little more than a postage stamp, contains about 5 in. of copper nickel wire, 0.001 in. in diameter, cemented to a piece of thin paper. When used, the gauge is cemented to the surface of the structure to be examined, and the strains set up in the latter produce measurable changes of resistance in the gauge wire. Suggested applications to logging operations are

structural analysis of pulpwood trailers, determination of the strains imposed on tow lines and the resistance offered by pulpwood rafts of different sizes and shapes, and analysis of the forces acting within a booming system. Methods of waterproofing and attaching the gauge are described.

339. MARKWARDT, L. J., and LISKA, J. A. **Speed of testing of wood: factors in its control and its effect on strength.** *Proc. Amer. Soc. Test. Mater.* 48, 1948 (1139-59). 5 refs. P.R.

Data are presented in the form of graphs and tables from recent studies on the effect of rate of loading on the compressive strength parallel to the grain and on flexural strength. Discussion, and suggestions for eliminating errors and controlling the speed of testing, are included.

340. SMITH, C. B., and VOSS, A. W. **Stress distribution in a beam of orthotropic material subjected to a concentrated load.** *Technical Note, National Advisory Committee for Aeronautics, Washington No. 1486, 1948.* pp. 39. 9 refs. P.R.

Mathematical expressions have been derived for the stress distribution in a wood beam of rectangular cross section subjected to a concentrated load. The orthotropic nature of wood was taken into account in the derivation. The stress distributions were expressed in terms of infinite series. A method of reducing the infinite series to the sum of a finite series and a closed form was described.

The mathematically determined distribution of horizontal shear in the vicinity of a concentrated load was compared with the actual distribution obtained by a test of a Sitka Spruce beam of rectangular cross section. *Author's summary.*

31.3. Chemical Properties

See also *For. Abstr.* 11
(Nos. 361, 363-4, 536).

341. **List of publications on chemistry of wood and derived products.** *Rep. U.S. For. Prod. Lab., Madison No. R238, 1948.* pp. 43. P.R.

342. **Advances in the chemistry of wood and its by-products in the U.S.S.R. during the last 30 years.** *Transl. Inform.*

Serv. Coun. sci. industr. Res., Aust. [n.d.] pp. 32. 64 refs. Transl. by M. Slade from *Zhurnal prikladnoy Khimii* 20 (11), 1947 (1083-96).

343. JENSEN, W. **The chemical composition of wood of White Birch [*Betula verrucosa*].** *Papp. Trävarutidskr. Finl.* 31 (7a), 1949 (20-6). 24 refs. [E.] P.R.

344. SITCH, D. A. **The isolation and fractionation of White Birch holo-cellulose.** *Pulp Paper Mag. Can.* 50 (3), 1949 (234-6, 290, 292). 26 refs.

A modified form of the Van Beckum and Ritter procedure, using water as a dispersion medium during chlorination, effected a rapid delignification of a large batch of wood meal of *Betula papyrifera* without appreciable losses of carbohydrate. The chlorite process of Jayme resulted in some loss of carbohydrate. A fractionation of White Birch holo-cellulose was attempted by a series of extractions with water at various temperatures and aqueous ethylene diamine solutions at different concentrations. The materials extracted by water at 95° C., and by 75% ethylene diamine at 95° C., were isolated and examined. The molar ratio of pentose to uronic acid was approximately 5 : 1 in the water-soluble hemicellulose and 8 : 1 in the ethylene-diamine-soluble hemicellulose. Methoxyl and acetyl were present in these materials, although there was some evidence of partial saponification of the latter during the extraction with ethylene diamine. *From author's abstract.*

345. JAYME, G., and SCHENCK, U. **Über die Schnellbestimmung des Cellulosegehaltes von Pappelholzern. [A rapid method of determining the cellulose content of Poplar wood.]** *Das Papier, Darmstadt* 2 (17/18), 1948 (323-7). 17 refs. [G.g.] P.O.
Cf. *For. Abstr.* 11 (No. 467).

346. WISE, L. E. **The chemistry of the hemi-celluloses.** *Pulp Paper Mag. Can.* 50 (3), 1949 (179-86). 54 refs.

347. RUSSELL, A., BAITY, J. H., and SMITH, H. E. **Interpretation of lignin. III. The synthesis and polymerization of stable monomers.** *J. Amer. chem. Soc.* 71 (3), 1949 (956-7). 4 refs. [Northern Regional Research Laboratory, Peoria, Ill.] O.R.S.

348. CERUTI, A. Su l'idratazione della lignina in rapporto alla sua specificità. [The hydration of lignin in relation to its specificity.] *Nuovo G. bot. ital. (n.s.)* 54 (1/2), 1947 (371-2). [It.] O.B.D.

Results of experiments in the hydration of lignin from the woody parts of the fruit of Almond, Olive, Walnut and Ginkgo, the lignin being prepared by the Hägglund method. Hydration capacity varies with species, not only in speed of hydration, but also in quantity of water absorbed.

349. ERDTMAN, H., and GRIPENBERG, J. Antibiotic substances from the heartwood of *Thuja plicata* D. Don. II. The constitution of γ -thujaplicin. *Acta Chemica Scandinavica, Copenhagen* 2 (8), 1948 (625-38). 23 refs. [E.e.] D.S.I.R.

350. GRIPENBERG, J. Antibiotic substances from the heartwood of *Thuja plicata* D. Don. III. The constitution of α -thujaplicin. *Acta Chemica Scandinavica, Copenhagen* 2 (8), 1948 (639-43). 2 refs. [E.e.] D.S.I.R.

351. ANDERSON, A. B., and GRIPENBERG, J. Antibiotic substances from the heartwood of *Thuja plicata* D. Don. IV. The constitution of β -thujaplicin. *Acta Chemica Scandinavica, Copenhagen* 2 (8), 1948 (644-50). 7 refs. [E.e.] D.S.I.R.

352. GRUNDON, M. F., and KING, F. E. Chlorophorin, a constituent of Iroko, the timber of *Chlorophora excelsa*. *Nature, Lond.* 163 (4145), 1949 (564-5).

Iroko, the decay-resistant timber of *Chlorophora excelsa*, contains 2-8% of an amorphous phenol, m.p. 157-159° C., which can be extracted by ether and has not hitherto been isolated. The authors propose for this substance the name 'chlorophorin': analyses of the crystalline tetraacetate, tetramethyl and tetraethyl ethers agree most closely with the molecular formula $C_{25}H_{30}O_4$. Chlorophorin appears to be a stilbene derivative (cf. pinosylvins), for which a partial structure is suggested.

353. CHAUDHRY, G. R., SHARMA, V. N., and SIDDQUI, S. Constitution of the colouring matters from *Sonneratia acida* Linn. *J. sci. industr. Res., India* 7b (12), 1948 (202). I.H.

31.4. Durability. Decomposition

31.41. Natural Durability

354. SMITH, D. N. The natural durability of timber. *Rec. For. Prod. Res., Lond.* No. 30, 1949. pp. 18. Price 6d.

Interim report of a field service test in progress at Princes Risborough. Results to date are given for about 100 species under test during the last 15 years. A tentative durability classification of these timbers has been prepared, and some suggestions are made on its practical application.

355. BAVENDAMM, W. Tests on the natural resistance of wood, particularly of tropical wood, to fungi, termites and marine borers. *Transl. For. Prod. Aust.* 1949. pp. 16. Transl. by P. A. Gibson from *Z. Weltforstwirtschaft*. 13 (7/9), 1948 (137-44). P.R.
A survey of field and laboratory test procedures.

31.42. Attack by Plant Organisms

See also *For. Abstr.* 11 (No. 471).

356. JENNISON, M. W., et al. Physiology of the wood-rotting fungi. *Summary Technical Report, U.S. Office of Naval Research* No. NRO34159, 1948. pp. 23. [Syracuse University, Syracuse, N.Y.]

Briefly indicates the procedures used and the main results obtained to date in respect of the physiology of the wood-rotting fungi, particularly the growth of wood rots in synthetic culture media.

357. JENNISON, M. W. The growth of wood-rotting fungi in submerged culture. *Abstr. in Amer. J. Bot.* 35 (10), 1948 (801). [Department of Plant Sciences, Syracuse University.] O.B.D.

The basidiomycetous wood-destroying fungi—both white and brown rots—grow readily in liquid media in shaken flasks or with forced aeration in deep cultures. Various species of the following genera have been so cultured at 28° C.: *Polyporus*, *Poria*, *Fomes*, *Hydnum*, *Armillaria*, *Daedalea*, *Lentinus*, *Lenzites* and *Peniophora*. Media in which most species make good growth include potato extract, malt extract, corn steep liquor, Curbay B-6 (condensed molasses-distiller's solubles), bran extract, soya bean meal extract and gluten.

358. CICCARONE, A. Verde iodio ed eritrosina nella differenziazione di parassiti fungini in tessuti legnosi. [The use of iodine green and erythrosin for distinguishing parasitic fungi in woody tissues.] *Nuovo G. bot. ital. (n.s.)* 53 (1/2), 1946 (358-9). [It.] O.B.D.

359. SZULETA, J. Cytochemiczne zmiany drewna sosnowego pod wpływem grzybów *Poria vaporaria* Fr., *Poria vaillantii* (De Cand.) Fr. i *Merulius lacrymans* Fr. [Cytochemical effects on Pine wood of *Poria vaporaria*, *P. vaillantii*, and *Merulius lacrymans*.] *Acta Societatis Botanicorum Poloniae* 18 (2), 1947 (217-37 + 3 plates). 14 refs. [Pol.f.] [Zakład Anatomii i Cytologii Roślin Uniwersytetu Warszawskiego.] C.G.B.

This study showed that:—(1) The hyphae of the mycelia penetrate longitudinally along the middle lamellae as well as in the tracheids themselves. The chief attacks were on the ray cells, the resin ducts and the tracheids of the early wood. (2) They pass from one cell to another either directly through the cell wall or through the pits. (3) In all 3 fungi clamp connexions are formed. (4) The decomposition of lignified walls is an enzymatic process, beginning with the primary wall, the bars of Sanio and the intercellular substance, and only later affecting the secondary layers of the wall. (5) In the author's material, decomposition consisted chiefly in the removal of the lignin, which is probably followed by degeneration of the cellulose and of the cellulose-pectic materials of the intercellular substance. (6) *M. lacrymans* was the most active of the fungi studied and its hyphae readily penetrated thick, lignified walls. (7) There was no difference between *P. vaillantii* and *P. vaporaria* in their mode of wood destruction; the latter differed from the former only in its thicker hyphae and more frequent production of chlamydospores. *From author's summary.*

360. SCHEFFER, T. C., ENGLERTH, G. H., and DUNCAN, C. G. Decay resistance of seven native Oaks. *J. agric. Res.* 78 (5/6), 1949 (129-52). 10 refs. O.R.E.

A study was made to ascertain by laboratory tests what differences in decay resistance existed (1) among some species of the commercially important Oaks, (2) among trees of the same species in 9 different regions of the U.S.A. and in different localities within the regions, and (3) in different parts of the same

tree. Seven species of Oak were tested, i.e. in the White Oak group, *Quercus alba* (White Oak), *Q. garryana* (Oregon White Oak), *Q. montana* (Chestnut Oak) and *Q. prinus* (Swamp Chestnut Oak); in the Red Oak group, *Q. borealis* (Northern Red Oak), *Q. coccinea* (Scarlet Oak) and *Q. velutina* (Black Oak). The White Oaks were substantially more resistant to decay than the Red Oaks. In order of decreasing resistance, the White Oaks are listed as follows:—*Q. montana*, *Q. garryana*, *Q. alba* and *Q. prinus*. Individual trees of the same species and approximately the same size and in the same locality, differed markedly in resistance to decay, while trees in different localities in the same region also differed significantly. The differences in trees from various regions was, on the whole, no greater than that in trees from different localities within the regions. This variability appears to be attributable to genetic differences rather than to environment, and the selection and breeding of resistant strains appears therefore to be a possibility. In one stand of *Q. alba* the outer heartwood increased in resistance as the d.b.h. became larger. In 3 species of White Oak and in *Q. borealis*, resistance to decay by 2 brown-rot fungi and a white-pocket-rot fungus decreased progressively from the outermost heartwood to the pith, the decrease being considerable enough to account for differences in service life in wood from different parts of large logs. Differences with 3 other white-rot fungi, however, were generally smaller and in White Oak an opposite trend was observed with 2 of the fungi. In the same 4 species the heartwood was, with one exception, more resistant in the upper part of the trunk than the lower. The variability in decay resistance with locality indicates that comparisons of species for decay resistance are unreliable unless many trees from numerous localities and of the same size are tested by means of samples taken from about the same place in each tree.

361. ZABEL, R. A. Variations in the decay resistance of White Oak. *Tech. Publ. N.Y. St. Coll. For.* No. 68, 1948. pp. 53. 52 refs.

Experiments were made to show the relationship between decay resistance and radial variations, and chemical and physical factors, and studies were made on the toxicity of hot-water extractives. Results, which are given in

graphs and tables, are based on experiments on 3 trees only, and although it is probable that data will hold good for White Oaks in general this cannot be assumed without further research. The durability of the heartwood varied with radial position, decreasing inward towards the pith; the wood nearest the pith was less durable than the sapwood in 2 of the 3 trees. A direct relationship was found to exist between specific gravity, the number of rings per in., and age respectively, and weight loss; and an inverse relationship between rays per in. and weight loss. The quality of hot-water extractives and tannins present can be closely correlated with durability per radial position. Within trees the toxicity of the hot-water extractives increased in the outer radial positions of the heartwood, suggesting that a gradual decrease in toxicity occurs with age. The variations in toxicity of extractives from the 3 trees, and the close relationship between toxicity and durability, suggest the possibility of using toxicity of the hot-water extractives as an additional index of durability. There is strong evidence that the tannins are responsible for the toxicity of the extractives.

31.43. Attack by Animal Organisms

See also *For. Abstr.* 11 (No. 695).

362. SCHLOTTKE, E. Über die Verdauungsfermente im Holz fressender Käferlarven. [On the digestive enzymes of wood-eating beetle larvae.] *Repr. from Zoologische Jahrbücher (Physiologie)*, Jena 61 (1/2), 1945 (88-140). 20 refs. [G.g.] P.R.

363. FRISON, E. La teneur en amidon des bois et leur susceptibilité aux attaques de *Lyctus*. [The starch content of timbers and their susceptibility to *Lyctus* attack.] *Echo des Bois* 40 (42; 43), 1947 (4-6; 7-9). [F.]

There is general agreement among wood technicians that wood containing no starch is immune to *Lyctus* attack. There is less certainty about the following generally held propositions:—(1) That there do in fact exist starch-free woods. (2) That starch, when present, occurs only in the sapwood. (3) That species with hard heartwood will not show starch in that heartwood. (4) That starch occurs only in the parenchyma and medullary rays. (5) That the maximum starch content

of any wood is about 6%. (6) That careful kiln drying of wood will completely rid it of starch. (7) That starch depletion will take place in wood slowly air dried at a moderate temperature after felling.

In order to verify these statements, a minute examination was made of the existing timber specimens and microscopic preparations at the Belgian State Laboratories, leading to the following results:—(1) Examination of 4 specimens of Greenheart (*Ocotea rodiaei*), which is usually stated to be quite free from starch, disclosed considerable quantities of starch. (2) Though, in general, starch does not occur in large quantities except in the sapwood, this does not apply to those species which form no heartwood; these may have considerable proportions of starch throughout their bulk, and these proportions may vary considerably (at least in temperate species) according to the season and method of felling. (3) A temperate species with hard heartwood may be considered practically free from appreciable quantities of starch in the heartwood, but this is not true of tropical species. Considerable quantities of starch were found in the extremely hard heartwood of *Astronium fraxinifolium* and *A. graveolens*. (4) A specimen of *Bosqueia angolensis*, contained a surprising amount of starch, but all of it in the lumen of the wood fibres; the medullary rays were filled with siliceous concretions. The 2 species of *Astronium* mentioned above also contained starch in the lumen of the wood fibres. (5) The estimated proportion of about 6% for maximum starch content is often exceeded by some tropical species. Thus in the specimens of *A. fraxinifolium* the starch content was 15-20%, and in *Bosqueia angolensis* not less than 30%. (6) Experiments with kiln drying up to temperatures of 105° C. left the starch intact. It is probably the sterilizing effects of heat on fungi or insects already in the wood which have led to the supposition mentioned above. (7) There was no evidence of starch depletion as a result of air-drying.

Presence or absence of starch is tabulated for a number of temperate and tropical species. It is remarkable that the Ashes (*Fraxinus excelsior*, *F. americana*, *F. mandshurica*, *F. nigra*) proved practically free from starch, though they have the reputation of being very susceptible to *Lyctus* attack and often do not form heartwood until their 40th year. Of the

tropical species, the following have exceptionally high starch content:—*Ceiba pentandra*, *Triplochiton scleroxylon*, *Bombax malabaricum*, *Terminalia superba*, and *Mitragyna stipulosa*. It is suggested that there may be a periodicity in maximum starch content in these species, which would account for the occasional occurrence of specimens of *T. superba* altogether free from starch.

364. AMOS, G. L. **Siliceous inclusions in wood in relation to marine borer resistance.** Repr. from *J. Coun. sci. industr. Res. Aust.* 21 (3), 1948 (190-6). 12 refs.

Australian Turpentine (*Syncarpia laurifolia* Ten.) has a world-wide reputation for marine-borer resistance. Recently, however, it has been reported [see *For. Abstr.* 9 (No. 2290)] that timber from this species grown in plantations in the Hawaiian Islands had a comparatively low resistance. Specimens of both Australian- and Hawaiian-grown Turpentine were therefore examined and it has been shown that the Australian material had numerous siliceous inclusions in the ray cells and a high silica content (average 0.59%) in contrast with the comparative lack of inclusions and low silica content (average 0.09%) of the Hawaiian-grown material. This comparative lack of silica has been suggested as the reason for the low marine-borer resistance. Support for this suggestion has been derived from the observation that various Australian and New Guinea timbers of known marine-borer resistance also contain many siliceous inclusions, and from evidence in the literature relating silica content and marine-borer resistance. Alternative theories regarding the possible effect of silica on the marine borers have been discussed and reference has been made to the mechanism by means of which the plant might take up silica. *From author's summary.*

365. EDMONDSON, C. H. **Reaction of woods from South America and Caribbean areas to marine borers in Hawaiian waters.** *Carib. For.* 10 (1), 1949 (37-42). [E.Span. f.] [Bishop Museum, Honolulu.]

Woods of more than 80 species are listed in the following 3 categories:—(1) considerably resistant, (2) moderately resistant, and (3) little resistant.

366. CLAPP, W. F. **Tests assure adequate warning of marine borer attacks in**

New York harbor. *Civil Engineering, New York* 17, 1947 (38-41, 84). L.S.

Test boards maintained in New York harbour have proved adequate in indicating the existence of danger from marine borers. The boards, 44 in number, are composed of removable untreated Pine blocks, and blocks are removed every month for analysis. The presence of fouling organisms has proved an excellent indication of conditions favourable to marine borer activity.

31.45. Injury by Fire

367. MIDGELEY, M. B. **Some thermal characteristics of certain types of wood.** Repr. from *Proceedings, Leeds philosophical Society (scientific Section)* 5 (1), [1947] (33-59). 4 refs. P.R.

Thermal conductivity and diffusivity were measured in 4 British species of wood (*Quercus robur*, *Fraxinus excelsior*, *Fagus sylvatica* and *Pinus sylvestris*) at a temperature just below burning temperature, believed to be roughly that attained just in advance of a burning area. Results reveal the variability of wood as an experimental material even within a given species, but figures also indicate that species differentiation with respect to thermal conductivity is lost when the measurements are made on material which has been charcoaled. Figures for diffusivity are difficult to interpret but indicate clearly a difference in the behaviour of air- and oven-dried wood, which has been shown to be due to physical rather than chemical factors. Preliminary experiments at a higher temperature reveal the importance of the part played by charcoal as a barrier to heat flow before being ashed away by greater heat energy accumulation. Results are expressed in graphs and tables. *From author's summary.*

368. WIDELL, T. **Thermal investigations into carbonization of wood.** *Handl. IngVetenskAkad., Stockh.* No. 199, 1948. pp. 35. 8 refs. [E.e.] P.R.

Test pieces of *Pinus sylvestris*, *Picea abies*, *Betula verrucosa*, *Fagus sylvatica* and *Populus tremula* were heated internally and externally by electricity, and measurements made of the temperatures of the test pieces and of the heat loss. Results are shown in graphs and tables. A slight endothermic reaction occurs during heating up to 80° C.; this continues during

further heating up to about 250° but appears to correspond to the heat of evaporation of moisture from the wood at about 10% moisture content. Round 250° an exothermic reaction begins but takes place so slowly that if the wood is heated rapidly exothermic heat will develop only at a higher temperature, after sufficient time has elapsed for the reaction to take place. The exothermic reaction can therefore be moved by rapid heating to temperatures above the range 300–400° C. *From author's summary.*

31.8. *Quality and Defects of Timber*

See also *For. Abstr.* 11 (Nos. 386).

369. PAUL, B. H., and SWEET, C. V. **Quality control in manufacture of lumber from second growth.** *Sth. Lumberm.* 178 (2230), 1949 (48, 50, 52).

Five causes of twisting in lumber cut from second growth are suggested:—(1) crooked logs, (2) growth rings of sharp curvature, (3) spiral grain, (4) internal stresses, and (5) high longitudinal shrinkage, as in fast growth at the centre of Southern Yellow Pine trees and in compression and tension wood. The following recommendations are made for improving the quality of timber from young second-growth stands, particularly Southern Yellow Pine:—(1) Avoid combining wood of less than 4 rings per inch and wood of slower growth in the same piece. (2) Taper sawlogs that have wide variations in growth rates. (3) Avoid the use of compression wood for high-grade products. (4) Dry lumber thoroughly and carefully before shipping, in order to sort out the badly warped pieces.

32. HARVESTING OF WOOD.

LOGGING

See also *For. Abstr.* 11 (Nos. 338, 775).

370. BROWN, N. C. **Logging: the principles and methods of harvesting timber in the United States and Canada.** John Wiley & Sons, Inc., New York. 1949. pp. 418.

A comprehensive work with sections on: general aspects; forest resources and stumpage valuation; labour and housing; selective logging; felling and crosscutting; and transport by land and water, including animal skidding, tractor logging, power logging, loading, chutes, wheeled

vehicles, sleds, motor lorries, forest railways, floating and driving, river and lake rafts and booms, ocean rafts, flumes, barges and steamers. There are numerous illustrations, graphs and tables.

371. **The pulpwood harvest.** Canad. Pulp Pap. Ass. 1949. pp. 16.

A semi-popular account of the methods of harvesting pulpwood in Canada, together with statistics of production.

372. ARNOULET, M. *L'exploitation forestière: abatage et conditionnement des bois de feu: récupération des petits bois.* [Forest utilization: felling and preparation of firewood: recovery of small wood.] J. & R. Sennac, 54 Faubourg Montmartre, Paris. 1944. pp. 135. [F.] Price 5s. 6d.

373. SOMERS, J. G. **Integration of forest industries.** *For. Chron.* 25 (1), 1949 (5–14).

Studies have been carried out in Manitoba and the results are here presented in tabular form and discussed. Table 1, based on volume tables and taper curves for White and Black Spruce, attempts to show theoretically the percentage of total volume which might be utilized from trees of different diameters if used (a) as pulpwood only, or sawlogs only, (b) as sawlogs to a top diameter of 5 in. and the rest as pulpwood to 3 in., (c) as sawlogs to a top diameter of 7–8 in. and the rest as pulpwood to 3 in. Table 2 shows (a) the (state) revenue return, (b) the financial return to the operator, according to the methods of exploitation mentioned above. Table 3 attempts to show theoretically the gross return to the operator on an area supporting 1½ million cu. ft. of Black and White Spruce, again according to the various methods of exploitation.

374. DRAKE, G. L. **Utilization of low-value hardwoods and softwoods in the Pacific Northwest.** *W. Cst. Lumberm.* 76 (3), 1949 (76, 78, 80, 82).

A brief account of developments in the market for low-grade logs in the Pacific Northwest. Factors influencing the situation are the increasing exhaustion of the supply of old-growth timber, better logging equipment, markets for smaller and defective logs in the pulping and veneer industries, and more economical sawmill practices.

32.2. Felling and Related Operations

See also *For. Abstr.* 11 (No. 714).

375. **German tool industry. Section 7. Heavy edge tools.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1628 (Section 7), Item No. 31, [n.d.] pp. 27 + 69 photos, drawings, dgms. Price 7s. P.R.

Includes an account of the manufacture of felling axes, hatchets and wood splitting wedges. Supplies of timber for handles are very short. Beech was being used in place of Ash, and Oak and Birch had been tried.

376. LEVESQUE, H., and LAMOTHE, G. E. **Report on use of the mechanical saw.** *Woodl. Sect. Index Can. Pulp Pap. Ass.* No. 1007 (B-7-C), 1949. pp. 6.

Time studies to compare the performance of power and hand saws both for felling and for crosscutting of pulpwood. It is concluded that the performance of the power saw lies somewhere between 114% and 155% of the hand saw, for average men at conventional logging. Experienced power sawyers will increase this percentage. In tests with 2 and 3 men using hand saws for felling and a power saw for crosscutting, the power saw (one per crew) was found to give very little advantage; owing to lack of training the men interfered with one another and much time was lost.

377. MAR'IN, P. A. **Elektropily na raskryazhevke shpal'nika i krepzha. [Cross-cutting sleeper logs and pitprops with electric saws.]** *Lesnaya Prom.* 1948 (12), (13-4). [Russ.]

In order to cope with rapid increases in the amount of timber dealt with at the Kirov log conversion depot, electric power saws were substituted for manual work in 1947. For cross-cutting logs into sleeper lengths at the depot, teams of 4 men—a sawyer, a log marker and two hands—are used. The sawyer has two saws, used alternately to avoid overheating. Time studies showed that the average log of 32 cm. diam. takes 49.5 seconds to cut, while moving to the next log takes 42.6 seconds. The mean output per saw-shift was 77-80 cu.m., or ca. 21 cu.m./man-day. Working in 3 shifts, 17,000 cu.m. of sleeper timber were cut between June 1 and Sept 1. For cutting pitprops from 60,000 cu.m. of rafted timber which came to land near the depot, a portable

generator and teams of 6 men were sent out to the spot, two extra hands being needed to break up the raft bundles and prepare them for cutting. The organization of this work is illustrated by a diagram. The output per power-saw/shift was 45-46 cu.m. or 7.5-8.5 cu.m./man-day, reckoned as being 62% more efficient than manual work. The use of power saws at such depots enables logs to be converted at any desired point over a considerable area.

378. G[EET]E, E. **Den norska enmans-motorsågen 'Jo-Bu'. [The Norwegian 'Jo-Bu' one man chain saw.]** *Skogen* 35 (18), 1948 (212). [Sw.]

Brief notes on a demonstration near Stockholm of a petrol-driven chain saw produced by A/S Jo-Bu Mek. Verkstad, Nesodden, Fagerstrand, having a 125 c.c. motor developing 4.5 h.p. at 3,000 rev./min., weighing 17 kg. with full petrol tank, and costing Kr. 1,350. The tank can be adjusted to various positions according to convenience. A simple lubricating device prevents the chain from clogging with resin. After notching by axe, Scots Pine of 50 cm. [diam.] was felled in 40 seconds and one of 40 cm. in 30 sec., while a 25 cm. log was cross-cut in 10 secs. The saw will cut to a stump as low as, or even lower than, that normal in felling by hand.

379. FOBES, E. W. **Bark-peeling machines and methods.** *Rep. U.S. For. Prod. Lab., Madison* No. D1730, 1949. pp. 22 + 15 photos, 3 dgms., 1 gph., 3 tbls. 46 refs. P.R.

380. SMITH, I. W. **Mechanical methods of bark removal.** *Paper Tr. J.* 126 (23), 1948 (45-50). 13 refs. P.R.

381. LEHRBAS, M. **Fence post barking machines in the South.** *Bull. La. For. Comm.* No. 3, 1947. pp. 23. [Southern Forest Experiment Station.]

382. ROBERTS, A. **Slash piling by machine on the Southern Idaho forest protective district.** *Fire Control Notes* 10 (2), 1949 (1-4).

Since 1945 it has been possible for logging operators on state and private lands in Idaho to contract their slash disposal to the State forest service at a more or less fixed rate. This article describes the slash-piling machines, adapted D-4 caterpillar tractors, which are

successfully used for this purpose. It is estimated that the cost is only about half that of hand piling.

383. HOLT, L. **Cutting costs in relation to tree size.** *Woodl. Res. Index Pulp Pap. Res. Inst. Can. No. 56 (F-2)*, 1949. pp. 5.

Analyses the felling costs on two areas, one of which was clear felled and the other cut to a diameter limit, and shows that, owing to the dependence of felling time on the tree size, the cost under selection felling is \$3.80/cord as compared with \$5.00/cord for clear felling. Other costs, such as those for marking and supervision, will tend to reduce this advantage, but selection cutting is likely in many cases to prove cheaper than clear felling.

32.8. Grading and Storage of Wood in the Rough

See also *For. Abstr.* 11 (No. 748).

384. ANDERSON, I. V. **Specifications for Western Larch peeler logs.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta. No. 69*, 1948. pp. 2.

385. ANDERSON, I. V. **Specifications for knotty Western White Pine [*Pinus monticola*] veneer flitches.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta. No. 68*, 1948. p. 1.

386. VAUGHAN, C. L. **What's under bark breaks?** *Sth. Lumberm.* 177 (2225), 1948 (161-2).

Account of a recent study by the U.S. Forest Products Laboratory in collaboration with the Southern and Southeastern Forest Experiment Stations, of the significance of bark breaks in grading sawlogs. Two classes of break are recognized, according as the appearance of the bark does or does not indicate the cause of the break.

387. ALLIOT, H. **Aperçu sur la protection chimique des grumes fraîchement abattues.** [Notes on the chemical protection of freshly felled timber.] *Bois For. Trop.* No. 8, 1948 (427-33). [F.]

Recommends the use of the oil preservatives Cryptogil EA6 and Xylophène 5E5, applied immediately after felling, for tropical species that are particularly susceptible to insect and fungus attack.

388. SALLENAVE, P. **La protection des grumes de Limbo après abatage.** [The preservation of logs of Afara [*Terminalia superba*] after felling.] *Bois For. Trop.* No. 8, 1948 (434-40). [F.]

Tests of a commercial oily preservative, Cryptogil EA6, applied either immediately or 2 months after felling, showed it to be successful in reducing considerably both the extent and the severity of insect and fungus damage. The effect appears to wear off after 2-3 months and a second treatment is desirable. Results are tabulated. [Cf. *For. Abstr.* 11 (No. 502).]

32.9. Transport

389. CHOLLET, A. **Le débardage et le transport des bois en Indochine du Sud.** [The extraction and transport of timber in southern Indo-China.] *Bois For. Trop.* No. 9, 1949 (25-38). [F.]

390. ALLOUARD, P. **Le véhicule tous-terrains dans l'exploitation forestière tropicale.** [The cross-country vehicle in the exploitation of tropical forests.] *Bois For. Trop.* No. 8, 1948 (379-88). [F.]

Summarizes the advantages and disadvantages of using cross-country lorries and tractors for combined skidding and transport operations, and concludes that in undeveloped land they can be used advantageously. Describes with illustrations some of the types available.

391. SIMMONS, F. C. **Good logging practice No. 16. Logging trucks.** *Timber of Canada* 9 (8), 1949 (33-6, 59-60).

392. **Weighing logs on truck.** *Timberman* 50 (5), 1949 (130).

A new air-actuated weighing system, adapted to practically all trailers which have an air brake equipment, has been produced by the Power Brake Equipment Co. of Portland, Oregon. Two round diaphragm members are placed under each bunk, and, when air is applied to the diaphragms, the load is lifted slightly, enabling a reading to be recorded on dials in the cab. An uneven load and the amount of unevenness will also be indicated on the gauges.

393. MCCOLL, B. J. **The trends of truck hauling costs.** *Pulp Paper Mag. Can.* 50 (5), 1949 (136, 138-40, 142-4). Also as *Woodl.*

Sect. Index Canad. Pulp Pap. Ass. No. 1008 (B-8-3), 1949. pp. 7.

A study, discussing and analysing costs of using various sizes of conventional lorry for pulpwood haulage in Canada under certain given conditions.

394. DUBOIS, P. Le treuil léger à bêche: ses possibilités. [The light winch with anchoring device: its possibilities.] *Bois For. Trop.* No. 9, 1949 (58-62). [F.]

Sets out the advantages of winches for skidding and stump-grubbing, especially in tropical forest, and gives some account of a winch with self-anchoring device, manufactured by the Société des Treuils PAN, which can be mounted on various types of tractor of medium (35-60) horse-power, and has a capacity of 5-6 tons. The average weight of such a self-anchoring winch equipped with 150 m. of cable is about 350 kg.

395. SUNDBERG, U. Lunning med traktor: praktiska erfarenheter och resultat från SDA:s studier. [Tractor skidding: practical experience and results of studies by S.D.A.] *Skogen* 36 (5/6), 1949 (68-9). [Sw.]

Until recently, Swedish experience has on the whole been unfavourable to tractor skidding, largely because the caterpillar tractors available were too big and expensive to run and were not built for broken and stony ground. Results with wheeled tractors have not been and are still not encouraging, but since the war lighter and more suitable caterpillar models have become available. The present paper briefly describes studies of skidding in 3 different districts in 1947-8, using Oliver 'Cletrac' HG tractors (weight 1,340 kg.) and two types of skidding sledge (both illustrated). Results are compared in time and cost graphs with those of horse skidding. On the basis of 7,000 working hours as the period for amortization, they show tractor skidding costs as 75-85% of those of horse skidding. Rubber tracks had no advantages over steel tracks and are more liable to wear and tear. Caterpillar tractors of this type cannot be used on very steep and rocky ground, but they will do good work over unfrozen boggy land where horse skidding is impossible until the ground freezes. They are likely to be especially suitable where logging has to be done in summer or autumn.

396. SAMUELSSON, E. En traktorkälke [A tractor-drawn sledge.] *Skogsägaren* 24 (10), 1948 (214-5). [Sw.]

Describes, with scale diagrams, a simple device for tractor hauling, invented by T. Hallgren and used successfully in the Finspång forests of Fiskeby Fabriks AB. The chief feature is the transfer of as much weight as possible to the rear of the tractor, thus improving the grip of its rear wheels. The sledge proper is coupled as usual with a chain to the tractor hook. On top of the sledge is mounted a stout wooden frame of 4 × 5-in. timber, to carry the load. The longitudinal axis of the frame is formed by two beams between which slides a 4 × 4½-in. I-beam attached at its front end to a separate coupling at the rear of the tractor. This device gives some play so that the tractor, when stuck, can back a little for a fresh start without having to move the sledge and its load at the same time. Loads of about 200 cu. ft. were hauled.

397. WILLISCROFT, A. D. Report on use of 'Caterpillar' D.W. 10 wheel type diesel tractor for hauling of softwood logs on sleighs on the operations of Price Brothers and Company near Rimouski, Quebec. *Woodl. Sect. Index Can. Pulp Pap. Ass.* No. 1002 (B-8-f), 1949. pp. 7. 13 tbs.

398. KARLBERG, Å. Utrullning av virke med hjälp av traktor. [Launching timber by tractor.] *Skogen* 36 (5/6), 1949 (65-6). [Sw.]

Briefly describes an experiment in the spring of 1948, when an Allis-Chalmers HD7W tractor, weighing with its bulldozer blade ca. 10 tons, was used to launch sawtimber and pulpwood. None of the wood had been stacked or sited specially for launching by tractor. The sawtimber logs, of varying length, were in piles of 2-3 layers; whereas the pulpwood, in 10½-ft. lengths, was in stacks of 8-12 layers (2½-3 m.) high. Completely barked pulpwood was readily launched, but that barked only in strips tended to form jams by the shore. Pulpwood stacks 10-15 m. long were satisfactorily launched, even where there was a gentle slope up to the bank and the wood was strip-barked, provided that there was enough clearance (at least 1½ m.) between adjacent stacks. Crooked or obliquely placed stacks often fouled their neighbours. The sawtimber went well where there was enough side clearance. Less timber was damaged than had been

expected, and a good deal of such damage could be avoided if a few men were provided to direct the tractor driver and pull away any logs that might be crushed under the caterpillar track. Where high-built stacks are to be launched, the risk of logs falling back on to the driver can be greatly reduced by standing a few pieces of pulpwood between the dozer and the stack of wood. It might be worth while to fix special upright guards to the dozer blade. On flat ground the tractor launched *ca.* 20,000 cu. ft. of completely barked pulpwood and 200 sawlogs in 49 minutes. Costs for this time amounted to Kr. 60, whereas manual launching would have cost Kr. 450. Trials are to continue, and on the basis of this first trial the riverside depots have been improved in various ways. It is noted in conclusion that in dry weather jams are often readily broken up if they are sprayed with water from a fire pump to reduce friction.

399. CERMAK, F. Le flottage des bois en A.E.F. [**Rafting of timber in French Equatorial Africa.**] *Bois For. Trop.* No. 9, 1949 (39-48). [F.]

Deals largely with methods of constructing rafts.

400. GLOVER, H. J. **White River Lumber Co.'s log-pond boat.** *W. Cst. Lumberm.* 76 (3), 1949 (84).

The boat described is made of two 36-in. Spruce logs, 32 ft. long. A 5-in. slab is sawn off both top and inside, and the logs are spaced 24 in. apart, making the boat 7 ft. wide in all. Two 10 × 16-in. ties, bolted to the logs near either end, and a 2-in. decking, add stability. The craft is driven by a 110-h.p. Chrysler Imperial motor, set near the stern. The outsides of the logs are lined with a 10-in. steel plate, and the boat is reinforced with steel plate both fore and aft. Its draught is only 2 feet. A frame on the bow holds a vertical bar extending about 16 in. below and 8 in. above the water line, making it possible to push logs and booms of logs. For ice-breaking, this bar and the side plates can be replaced by a breaker bar extending several feet under the boat.

401. **Air tongs for shovel log loaders.** *W. Cst. Lumberm.* 76 (5), 1949 (72).

Describes the Rees air tongs, a new log-loading device used by the Crown-Zellerbach Corporation. The hinged tongs are installed on the boom of a modified mechanical shovel,

and are powered by an air compressor of about 50 cu. ft. capacity providing pressure of up to 100 lb. [sq. in?]. The shovel operator has full control, i.e. can open the tongs, lower the boom, slide it in or out to reach the log, close the tongs and raise the boom to carry the log to the point of release.

402. **New small log loader developed in East.** *B.C. Lumberm.* 33 (3), 1949 (152).

A new device for loading logging trucks (lorries) has been developed by Phil Wood Industries, Windsor, Ontario. The loader, which is operated by hydraulic power, is mounted on a conventional truck chassis and loads the logs by lifting arms which hinge down from the side of the truck. When the arms are lowered, logs are rolled on to them, and are retained by an upward curved section at the ends. The arms are raised by means of an operating lever, and the logs placed on the truck. Adjustable fingers on the arms determine the appropriate loading height.

403. STOLPNIK, P. S. Nový avtomobil'ny kran dlya pogruzki lesa. [**A new lorry-mounted crane for loading timber.**] *Lesnaya Prom.* 1948 (12), (12-3). [Russ.]

Describes, illustrates and gives the specification of A. D. Fakeev's 790-kg. crane, mounted on a lorry and powered by its motor. The crane arm can rotate through 180° to facilitate loading from any desired point; in its working position it is supported at its middle by legs in the form of an A-frame which stands on the ground clear of the lorry. A load of 2 tons or 2.5-3 cu.m. can be handled. In trials, this crane dragged in bundles of logs from 30-35 m. away and loaded a lorry of 8-10 cu.m. capacity in 10-12 minutes, using a team of 5 men. It can also be used for loading railway waggons, in which case a performance of 2.50 cu.m. per 8-hr. shift is possible with the same team. Bundles of logs of 3.5-4 cu.m. can be skidded in from a distance of 100 m. in 5-7 minutes. Only 2-3 minutes are required to get the crane from its working position into its position for moving to a fresh site.

404. GUTSEVICH, E. P. Pogruzochny kran 'Karellesovets'. [**The 'Karellesovets' loading crane.**] *Lesnaya Prom.* 1948 (12), (8-9). [Russ.]

An illustrated description, with specification, of the prototype of a self-propelled 12-ton crane

designed for running on narrow-gauge railways. The chief feature is that the trolleys on which it runs are mounted so that they can be lifted out of the way when the crane is in action, the crane then being supported on the ground by legs which leave the railway track clear, so that waggons can pass underneath the crane cabin for loading. Loads of 1.5–2 metric tons can be dealt with. A 7.2-KW., 220-volt generator, driven by liquid fuel or producer gas, supplies the motor. Power can also be supplied to electric chain-saws up to a distance of 200 m. The crane is capable of skidding logs in for 150–200 m. Tests were satisfactory and the model has been approved, with slight modifications, by the Ministries of Forestry and the Paper Industry.

33. CONVERSION AND PRESERVATION OF WOOD

405. KOLLMANN, F. *Technische Massnahmen zur Entlastung der Holzbilanz. [Technical measures to redress the balance of wood consumption and production [with chief reference to Germany and the continent of Europe].]* *Silvae Orbis* No. 7, 1943. pp. 81. 131 refs. [G.g.]

Considers, for each of the main uses of wood, the possibilities of economies by means of modified grading practice, standardization, preservation, utilization of waste, substitution, etc. [Cf. *For. Abstr.* 8 (No. 2685).]

406. EDLIN, H. L. *Woodland crafts in Britain: an account of the traditional uses of trees and timbers in the British countryside.* B. T. Batsford Ltd., London. 1949. pp. x + 182. Price 15s.

407. COX, H. A. *Woodland industries.* *Wood* 14 (4), 1949 (122–3).

An account of some British industries and crafts (both past and present) based on coppice crops and small timber.

33.1. Mechanical Conversion excluding the Manufacture of Mechanical Pulp

408. CORTI, M. A. *High speed wood cutting tools [of tungsten carbide].* *Rep. 7th Vit. Wood Prod. Conf.* 1947 (12–7). P.R.

409. **Swiss woodworking machines.** *Timber News* 57 (2116; 2117; 2118), 1949 (74–6; 113–5; 158).

An illustrated account covering saws, multi-purpose and general woodworking machines, planes, sharpening machines, machines used in the plywood and veneer industry, etc.

410. BRUNDAGE, M. R. **Electronic detection of concealed metal in timber.** *Proc. nat. Shade Tree Conf.* 1948, 1949 (74–80).

Gives some account of the various mine detectors etc., available for the detection of metal in wood, and a suggested procedure for searching growing trees.

Use of Wastes

See also *For. Abstr.* 11

(Nos. 474–6, 479, 484, 486, 571).

411. HUGHES, H. **Sawdust as a compost ingredient.** *Quart. J. For.* 43 (2), 1949 (77–8).

It has been observed that conditions dangerously toxic to plants, arise in the soil where certain fungal activity is present which is able to produce complex organic acids that are in turn transformed into sulphides. Such activity has been found when sawdust derived from hardwood trees has been mixed with the soil and has remained there for a long time owing to its slow rate of decomposition. It appears that when such fungal spores are present in the soil, and under suitable conditions of environment and climate, certain hardwood sawdusts can promote their growth. Conifer sawdusts apparently do not share this property. Considerable field research is necessary before any particular hardwood species can be identified as responsible.

33.12. Joinery, Turnery, Furniture and Cabinet Making

See also *For. Abstr.* 11 (No. 600).

412. HAYCOCK, A. H. **Principles of machine woodworking. Spindle moulder methods.** *Wood* 14 (3–5), 1949 (89–92; 119–21; 154–5).

413. **General specification for utility furniture.** Board of Trade, London. 1948. pp. 5 + 6 + 11 + 10 + 13 + 5 + 3 + 69 dgm. P.R.

414. TURNER, N., and WEBSTER, C. **Tests to determine the effect of mechanical restraint during conditioning on the glue layers and final shape of laminated bends.** For. Prod. Res. Lab., Lond. No. W.B./15, 1949. pp. 10. P.R.

Tests were carried out on 80 bends, each consisting of 13 laminae, in which movement during conditioning was restrained by a wooden tie-piece across the end of the bend. This restraint was found to reduce the final deviation from the shape of the jig by about 40%. It did not appear to cause failure in the glue layers. When the 'slack' side of sliced laminae formed the convex face of the bend, hair-checks tended to develop; these defects are unlikely to occur when sawn laminae are used. If, during pressing, laminae are so clamped that they are unable to slide freely over each other, failures in the glue layers are likely.

415. **Glued laminated frames.** *Timb. & Plyw.* 95 (2474), 1948 (959-60). P.R.

Describes the use of laminated wood manufactured with synthetic glues for coachwork.

33.15. Manufacture and Use of Veneers and Laminated Wood. Improved Woods. Laminated Materials other than Wood. Glues and Gluing

See also *For. Abstr.* 11 (Nos. 384-5, 509).

416. JALAVA, M. **The significance of Birchwood for Finland [for plywood and bobbins and spools].** *Papp. Trävarutidskr. Finl.* 31 (7a), 1949 (46-8). [E.] P.R.

33.15.1. Manufacture of Veneers and Laminated Wood

See also *For. Abstr.* 11
(Nos. 414-5, 435-44, 490, 524).

417. PERRY, T. D. **Taking the twist out of veneer.** *Wood Prod.* 54 (5), 1949 (39-44).
An account of the tenderizing process.

418. IYER, N. K. A. **Plywood manufacture in India.** *W. Cst. Lumberm.* 76 (2), 1949 (76, 78, 82, 126).

419. NICHOLS, W. **Moulded plywood. An introduction to flexible bag moulding.**

Timb. & Plyw. 95 (2455-6; 2458-9; 2462-3), 1948 (179; 217-8; 301-2, 304; 339-40; 459-60; 505-6, 508). 4 refs. P.R.

420. NICHOLS, W. **Plywood repairs: simple ideas for patching panels.** *Timb. & Plyw.* 96 (2493), 1949 (683-4). P.R.

33.15.2. Use of Plywood and Other Laminated Wood

See also *For. Abstr.* 11
(Nos. 537-9, 547-8, 620).

421. NORRIS, C. B., and RINGELSTETTER, L. A. **Buckling of stiffened, flat, plywood plates in compression.** *Rep. U.S. For. Prod. Lab., Madison* No. 1553-C, 1948. pp. 6 + 2 photos, 2 gphs., 2 tpls. P.R.

The results of 38 tests of plywood plates subjected to edgewise compression are presented in graphs and tables. The plates were stiffened by a single stiffener bisecting the plates and parallel to the direction of the stress. The face grain of each plate was inclined at an angle of 45° to its edges. An approximate formula for the critical stiffness of the stiffeners was obtained. The tests show that when a plywood plate is stiffened in the manner described, its critical buckling load may be increased about 4 times. The weight of the stiffener is small compared with that of the plate.
From authors' summary.

422. DIETZ, A. G. H. **Two-species laminated beams.** *Trans. Amer. Soc. mech. Engrs.* 71 (4), 1949 (401-5). 10 refs. P.R.

This paper sets forth the simple theory of 2-species wooden beams incorporating high-strength heavy outer laminations or 'flanges', together with low-strength lighter cores, into glued laminated members having high strength and high stiffness. Expressions for transformed section, ratio of core depth to over-all depth, and shear at the neutral axis are derived. A few beams made of Douglas-Fir outer laminations and No. 1 or No. 2 common Eastern-Spruce cores were tested and their strength properties determined. Their performance coincided quite well with that predicted by the theory. A 'form factor' similar to that for wooden I-beams may be involved. *Author's summary.*

33.15.3. *Improved Woods*

See also *For. Abstr.* 11 (Nos. 337, 550-1).

423. SCHWARTZ, J. R. Bois améliorés. [**Improved woods [solid and laminated].**] *Rev. Bois Appl.* 3 (9/10), 1948 (14-9); 4 (4), 1949 (14-8). 32 refs. [F.]

424. SEBORG, R. M., MILLETT, M. A., and STAMM, A. J. **Heat-stabilized compressed wood (Staypak).** *Rep. U.S. For. Prod. Lab., Madison* No. 1580, (rev.) 1948. pp. 11 + 1 photo, 7 gphs., 4 tpls. 16 refs. P.R.

Discusses the manufacture and properties [cf. *For. Abstr.* 7 (No. 304)] of Staypak. Results of experiments, given in graphs and tables, indicate that optimum manufacturing conditions are temperatures of 330-345° F., moisture contents of 6-10% and pressures of 1,400 lb./sq. in. for Yellow Birch and 1,600 lb./sq. in. for Sugar Maple. A variety of species proved suitable for the manufacture of Staypak; resinous pitchy solid wood should not be used. Staypak has less dimensional stability than Compreg, but superior strength properties, notably greater impact strength.

425. SVENSKA CELLULOSA A.-G. Procédé d'amélioration du bois par imprégnation avec des résines synthétiques durcissables. [**A method of improving wood by impregnation with synthetic resins capable of being hardened.**] *Swed. Patent* No. 119,422, Nov. 12, 1947. *Abstr. in Chimie et Industrie, Paris* 59 (6), 1948 (573). [F.] D.S.I.R.

426. PHILLIPS, B. J., and LATEGAN, P. N. **Impregnating and impregnated timber.** *Brit. Patent* No. 597,383, 1948. *Abstr. in Timber News* 57 (2119), 1949 (199).

The timber is first compressed and then restored to substantially its original volume by treatment with a polar liquid. The capacity of the timber to absorb such liquid and the rate of absorption are increased by the preliminary compression. Softwoods can be compressed more than hardwoods. A high moisture content facilitates the process of compression, but the drier the timber in the first place the more readily it re-assumes its shape in the presence of the impregnating liquid and the more rapid and complete is the impregnation. Heating the timber facilitates compression, but resinification of the lignin must be avoided. 'Polar liquid' refers to water, aqueous solutions, and certain non-aqueous organic liquids of high

dielectric constants, which have a polar attraction for cellulose molecules, and which, when absorbed in wood, cause swelling. Examples are glycerine, water-soluble phenol-formaldehyde and certain alcohols.

427. BRUNLER, M. O. Procédé pour le traitement des bois de construction. [**Hot-press treatment of structural timber.**] *Fr. Patent* No. 937,592, Aug. 20, 1948. [F.] *Abstr. in Rev. Bois Appl.* 4 (3), 1949 (32).

Describes a method of reducing the initial humidity of unseasoned timber by 10-12% in a few minutes. The wood is treated in a hydraulic press with heated plates (160-280° C.) under a pressure of 14-70 kg./sq. cm. The plates of the press are thick enough to accumulate sufficient heat to prevent them from cooling during evaporation of the moisture in the wood. Steel plates 50 to 100 mm. thick are suitable for most purposes. The press also has a device for releasing the pressure very gradually. Structural timber so treated is denser and more durable.

428. HAUCK, K.-H. Mechanische Eigenschaften von Kunstharz-Pressholz bei hohen Temperaturen. [**Mechanical properties of synthetic-resin densified plywood at high temperatures.**] *Kunststoffe, Munich* 38 (9), 1948 (181-5). [G.] D.S.I.R.

Discusses the German standard for different classes of densified plywood, giving a tabulated list of strength requirements at room temperature. Results, shown in graphs, of tests to show the effect on strength of temperatures from 20 to 150° C., indicate that bending strength decreases at higher temperatures and that impact strength is generally at its maximum at temperatures of 50-100° C. Relationships between the different classes specified in the German standard are not borne out by these experiments at high temperatures, and a revision of the standard is recommended.

33.15.4. *Laminated Materials other than Wood*

See also *For. Abstr.* 11 (No. 538).

429. MACKINNON, J. C., and HICKLER, W. R. **Structural material for aircraft.** *U.S. Patent* No. 2,456,005, 1948. *Chem. Abstr.* 43 (6), 1948 (2472). P.R.

Cotton-web plies impregnated with resin are made to adhere to a central core ply of wood

veneer (e.g. African Mahogany) about 0.01 in. thick, coated with a resin. On either side of the multi-layered material is another ply of the same wood veneer impregnated with resin. The whole assembly is subjected to moulding by pressure of about 60 lb./sq. in. at 300° F. The pressure is then released and the product allowed to cool in the press for about 15 minutes. The finished sheet material has a good tensile strength exceeding that of sheets of wood veneers alone.

430. KOMMERS, W. J., and NORRIS, C. B. **Effects of shear deformation in the core of a flat rectangular sandwich panel. Stiffness of flat panels of sandwich construction subjected to uniformly distributed loads normal to their surfaces—simply supported edges.** *Rep. U.S. For. Prod. Lab., Madison No. 1583-A*, 1948. pp. 10 + 2 photos, 1 dgm., 3 gphs., 5 tpls. 4 refs. P.R.

The facings are of aluminium or glass cloth. The core materials include Balsa wood.

431. MILLER, R. A., and LANGHAAR, H. L. **Flexural strength and stiffness of wood-aluminum sandwich panels.** *Product Engineering, New York* 19 (8), 1948 (104-8). L.S.

Tests were made on sandwich columns with cores of 8 different species; in all cases the grain of the wood was parallel to the direction of loading, but with Balsa additional specimens were constructed with the grain perpendicular (a) to the direction of loading and (b) to the aluminium skin. The results given in graphs and tables, show that, in general, column efficiency decreases with increase of core density. There is one exception: in the range of very short columns, sandwiches with Ponderosa Pine cores were slightly superior to those with Balsa cores. It should be noted that the comparisons are on a weight-for-weight basis and that some efficiently designed Balsa/aluminium sandwiches would be impractically thick. Sandwiches are most efficient when the core is relatively thin. For longer columns best results are obtained when the grain is parallel, for shorter columns when it is perpendicular to the skin. The worst results are obtained when the grain is parallel to the skin and transverse to the direction of loading.

A plain Balsa board is, weight for weight, stiffer than sandwich formations with wood

cores. A Balsa sandwich with grain perpendicular to the skin is less stiff than a plain Balsa board but stiffer than other wood sandwiches. Maximum stiffness for a given weight is obtained when the core is approximately twice the weight of the skins.

Results of tests on sandwich shear beams showed fairly good agreement with theoretical data. Tests on small sandwich beams gave moduli of rupture ranging from 75,000 to 90,000 lb./sq. in. The highest values were obtained for sandwiches with Birch cores, but these were much heavier than those with Balsa cores.

33.15.5. Glues and Gluing

432. PINTO, R. H. **Wood adhesives.** B. and F. N. Spon Ltd., 57 Haymarket, London, S.W.1. 1948. pp. 180 + 9 photos. 80 refs. Price: 12s. 6d. P.R.

433. **Animal glues: their manufacture, testing, and production.** *Rep. U.S. For. Prod. Lab., Madison No. D492*, (rev.) 1948. pp. 11. 13 refs. P.R.

434. RUSHTON, J. T., and COPLEN, L. C. **Preparation of resin adhesives.** *W. Cst. Lumberm.* 76 (2), 1949 (66, 68, 71). [Weyerhaeuser Timber Co., Longview, Wash.]

Discusses the mixing and storage of glues extended with Silvacon bark products.

435. KNAUSS, A. C., and SELBO, M. L. **Laminating of structural wood products by gluing.** *Rep. U.S. For. Prod. Lab., Madison No. D1635*, (rev.) 1948. pp. 63 + 29 photos, 9 dgms., 14 gphs., 4 tpls. 15 refs. P.R.

A comprehensive account, covering: historical background; advantages and limitations of laminated construction; glues; species and quality of timber; methods and equipment for gluing and curing laminated stock; testing; preservative treatment; and some examples of laminated construction in Europe and America.

436. WALTER OHR and UNITY HEATING LTD., BRISTOL. **Bonding of surfaces with synthetic resin glues.** *Brit. Patent No.* 600,198, April 2, 1948. Price 2s. *Abstr. in Timber News* 57 (2117), 1949 (122).

437. **New type hot press glues up face veneer, cross banding and core in one operation.** *Wood Prod.* 54 (3), 1949 (24).

A hot press with a single opening, which will make a complete veneered panel in one operation, has been placed on the market by Berthelsen Engineering Works, Inc., of Joliet, Ill. The press will glue the face veneers, cross-banding and core stock simultaneously in 1-2½ min., depending on the thickness of the veneer and panel. Six air-operated side pressure bars press the glued and unglued pieces of the core stock together and hold them rigid, while pressure is applied to the cross-banding and veneer by means of the steam-heated platens.

438. OKRETTIC, B., and COLLARDET, J. La machine américaine dans la fabrication des panneaux contreplaqués. Appareils pour le jointage et la réparation des placages. [American machinery for the manufacture of plywood. Machines for joining and repairing plywood.] *Bois For. Trop.* No. 8, 1948 (403-14); [F.]

An illustrated description of types of edge gluing machines, glue spreaders, presses, and knot menders, with a list of addresses of American firms supplying such machinery.

439. PERRY, T. D. **Fundamentals of edge gluing lumber.** *Wood Prod.* 54 (3), 1949 (39-42).

440. PERRY, T. D. **Tapeless veneer splicers.** *Wood Prod.* 54 (4), 1949 (39-40, 42-4).

441. THOMAS, D. P. **New veneer splicing technique.** *British Plastics*, London 21 (237), 1949 (107-9). D.S.I.R.

Describes equipment and edge-gluing methods developed at the University of Washington Forest Products Laboratory in which electronic heat is used for a rapid cure of the glue line.

442. SINGER MANUFACTURING COMPANY, U.S.A. **Improved electronic bonding machine.** *Brit. Patent* No. 599,300, 1948. *Abstr. in Timber News* 57 (2119), 1949 (199-200).

443. NICHOLS, W. **Modern assembly gluing.** *Timber News* 56 (2113; 2114), 1948 (433-4; 472-4); 57 (2115), 1949 (34-5).

444. NEWALL, R. J., and CARRUTHERS, J. F. S. **Investigations into glues and gluing.** Progress report 41. Part II. Influence of moisture content on the gluing

of wood. Tests on laminated blocks. For. Prod. Res. Lab., P. Risborough. 1948. pp. 5 + 4 photos, 4 tbls. P.R.

Describes and tabulates the results of the alternate wetting and drying of laminated blocks of Beech and Corsican Pine using different glues, and at different moisture contents of the wood. In the case of the Beech blocks none of the glues produced perfect bonds at the moisture contents tested (7½%, 12% and 17%). Urea-formaldehyde produced the best bond, its superiority being most marked at a wood moisture content of 7½% and least at 17%. Good bonds were obtained for Corsican Pine using urea- and phenol-formaldehyde and casein glues at a wood moisture content of 20%.

33.17. Sawmilling

445. CHIPP, W. F. **Sawmilling in the tropics.** *Malay. Forester* 12 (1), 1949 (4-16).

Advice on the economics, siting, equipment, and operation of small sawmills to provide for local needs in tropical colonies and dependencies.

446. CAMERON, G. R. **Sawmills [: notes for operating a bush sawmill or farm sawbench.]** *Rhod. agric. J.* 45 (5), 1948 (454-67). E.M.B.

447. BROOKS, R. D. **Circular saws: problems in the design, maintenance and operation of standard saws for all-purpose work.** *Mechanical Engineering*, Easton, Pa. 71 (2), 1949 (133-8). D.S.I.R.

448. Gleichdicke Kreissägeblätter für Holz. [Standard for] circular saw blades of uniform thickness.] *Önorm, Österreichischer Normausschuss*, Vienna No. M4402, 1948. pp. 2. [G.] Sold by British Standards Institution, 24-28 Victoria St., London, S.W.1. Price 1s. 9d. P.R.

449. NOYON, F. Une scie à ruban de 500 kgs de poids. [A band saw weighing 500 kg.] *Bois For. Trop.* No. 9, 1949 (101-3). [F.]

Description of a horizontal band saw, constructed by the Ateliers C.D. 'La Forestière' at Puteaux, which has given very good results in the sawing of tropical timbers at the laboratory at Nogent-sur-Marne.

450. HUNDAHL, R. Kraftforbruget ved Maskinsavning. [Power consumption in

mechanical sawing.] *Dansk Skovforen. Tidsskr.* 33 (9), 1948 (397-420). [Dan.] [Træbejrningsudvalget, Akademiet for de Tekniske Videnskaber.]

Gives the results of preliminary studies of power consumption in circular and band sawing of Beech staves as affected by rate of cutting, rate of feed, set of saw teeth and period of cutting, and discusses briefly the lines which further investigations should take.

451. FOBES, E. W. **Slab pick-up racks.** *Sth. Lumberm.* 178 (2229), 1949 (96). [Forest Products Laboratory, Madison.]

In western Pennsylvania sawmill slabs or other forest products are piled on to portable racks equipped with flanged wheels, which can be run on to ramps fitted with tracks. Trucks [lorries] with frames fitted with similar tracks, are backed up to the loaded ramp. The racks are drawn on to the trucks by means of a cable fitted to a power take-off winch situated behind the truck cab. Special screwjacks under the rear of the truck help to support the load as it moves on. An entire unloading and loading operation requires from 5 to 18 min., depending largely on the difficulties encountered in backing the trucks up to the ramps.

452. SOTOŠEK, S. Odbira hlodov za vzporedno obrobijene deske. [Selection of logs for producing boards with parallel edges.] *Gozd. Vestn.* 6 (1/2), 1947 (26-9). [Sloven.]

Jugoslavia is faced with an increasing demand for parallel-edged boards from exhausted forests. Yet the average outturn of sawn timber from the log is only 60 instead of 75%. The author gives a table showing for various widths of such boards the appropriate top end diameters that will minimize log waste.

453. HERRICK, A. M. **Grade yields and overrun from Indiana hardwood sawlogs.** *Bull. Ind. agric. Exp. Sta.*, No. 516, 1946. pp. 60. 3 refs.

33.3. Chemical Treatment

See also *For. Abstr.* 11 (Nos. 341-2).

Use of Wastes

See also *For. Abstr.* 11 (Nos. 480, 532-4).

454. **Wood pulping with magnesia:** U.S. initiates a cyclic recovery process.

Chem. Age, Lond. 59 (1533), 1948 (724-5). D.S.I.R.

455. MONNBERG, R. **Isolation of a form of technical lignin [from sulphite waste liquor] and some derivatives of this substance.** *Papp. Trävarutidskr. Finl.* 31 (7a), 1949 (11-8). 17 refs. [E.e.] P.R.

456. ADLER, E. Lignin som råmaterial för konstharts. [Lignin as raw material for synthetic resins.] *Medd. svenska Träforskn.-Inst. (Träkem. Papp tekn.).* No. 10, [1946]. pp. 5. 20 refs. [Sw.] *Repr. from Industrietidningen Norden* 21, 1946. P.R.

33.32. Pulp and Paper Manufacture. Wallboards. Plastics

See also *For. Abstr.* 11 (Nos. 371, 608-11).

457. Litteraturutdrag fra papirindustriens forskningsinstitutet. [Bibliography from the research institute of the paper industry.] *Suppl. to Norsk Skogind.* 3 (2), 1949. pp. 16. [Nor.] P.R.

458. La producción nacional de pasta de papel—gran incremento en el consumo de materias primas nacionales. [National production of pulp for paper—great increase in the consumption of native raw materials.] *Montes, Madrid* 5 (25), 1949 (71-3). [Span.]

Includes figures for production and consumption of pulp and for paper production in Spain.

459. SEIFFERT, J. **Paper manufacturing industry in Australia.** *Paper Tr. J.* 126 (23), 1946 (51-3). P.R.

33.32.1. Pulp Manufacture

460. LINDAHL, E. Undersökning angående fastmassan i sulfathack. [Investigation on the solid volume of sulphate chips [as supplied by AB Statens Skogsindustrier].] *Skogen* 36 (8), 1949 (106). [Sw.]

461. MURTO, J. O., and KIVIMAA, E. Selluloosapuun lastutus II. [Chipping of pulpwood II.] *Papp. Trävarutidskr. Finl.* 30 (21), 1948 (383-93). 6 refs. [Fie.] P.R.

Describes and discusses the results, shown graphically, of experiments to determine the effects of such factors as the state of the wood (strength properties, temperature and moisture

content), chip length, spout angles and sharpening angle of the knife, on chip thickness, the work required for chipping, the formation of chipping fines and the extent of chip damage.

462. MO OCH DOMSJÖ AKTIEBOLAG. **Wood: pulping; application of supersonics.** *Brit. Patent No. 604,864*, July 12, 1948. *Abstr. in Summ. curr. Lit. Brit. Cott. Res. Ass.* 28 (24), 1948 (588). D.S.I.R.

A method for the pretreatment of wood, etc., for the separation of cellulose from lignin and other constituents, involves submitting a suspension of the powdered material or chips to supersonic vibrations.

463. JAHN, E. C. **Improved pulp cooking methods.** *Unasylva* 2 (2), 1948 (63-6).

A brief review of recent advances.

464. SCHEPP, R. Über die Sulfitzellstoffkochung—Versuche zur Erzielung optimaler Zuckerausbeuten. [The sulphite pulping process—experiments to obtain an optimum sugar yield.] *Das Papier, Darmstadt* 1 (7/8), 1947 (140-5). [G.] P.O.

Pre-hydrolysis in sulphite pulping of Beech and Spruce was compared with the single-stage process, and it was concluded that the addition of a pre-hydrolysis stage offers no advantage when a pulp with a low hemicellulose content is required, nothing being gained either in pulp quality or in sugar yield.

465. KURENNIEMI, T., and MURTO, J. O. Elementaarisien rikin vaikutuksesta alkalisisä selluloosakeitoissa. [The effect of elementary sulphur on alkaline pulping.] *Papp. Trävarutidskr. Finl.* 30 (24), 1948 (437-44). 16 refs. [F.i.e.] P.R.

Experiments showed that the addition of elementary sulphur to the sulphate cook gave an increased pulp yield of nearly 20%. The pulp yield was increased at reduced cooking temperature. The results are given in graphs and tables.

466. FORMAN, L. V., and NIEMEYER, D. D. **Kraft pulping of southern hardwoods.** *Monograph Series, Technical Association of the Pulp and Paper Industry*, New York No. 4, 1947 (167-83). 2 refs. P.A.T.R.A.

Gives tabulated figures for the pulp yield and qualities of 39 hardwood species, classed as (a) containing no tannin, (b) containing tannin only in the bark, and (c) containing tannin in bark

and wood. Species giving the best yield and physical properties of pulp were: *Quercus shumardii*, *Q. falcata* var. *pagodaefolia*, *Halesia carolina*, *Q. coccinea*, *Ilex vomitoria*, *Q. palustris*, *Q. falcata*, *Gordonia lasianthus*, *Q. laurifolia*. All except the last two contain tannin in the bark and this could be recovered for commercial use. The most promising species for the dual purpose of pulping and tannin extraction was Coastal Chinquapin (*Castanea ashei*).

467. JAYME, G. Über den Einfluss der Sorte und des Standortes auf die chemische Zusammensetzung und Eignung von Pappelhölzern zur Zellstoffgewinnung. [The influence of species and site on the chemical composition of Poplar wood and its suitability for pulping.] *Das Papier, Darmstadt* 1 (9/10), 1947 (182-90). 15 refs. [G.g.] P.O.

Six different *Populus* species, ranging in age from 8 to 17 years (some of them from different sites) were investigated for their suitability for pulping. Chemical analyses of the wood were made to find its cellulose content and non-cellulose constituents. Yield and properties of sulphate cellulose from these woods were also investigated. *P. monilifera* from Baden (*P. serotina* according to Houtzagers) had a very high cellulose content (47.21-49.91%), exceeding that of Spruce, and gave a 56.34% yield of sulphate pulp. Equally good results were obtained with *P. bachelieri* (cellulose content, 48.41%, sulphate pulp yield, 57.96%). *P. generosa* from Köln gave good results (cellulose content 49.14% and sulphate pulp yield 59.84%), whereas a specimen of the same species from Lundenburg gave much lower yields (cellulose 43.18%, sulphate pulp 54.71%). Only moderate results were obtained with *P. trichocarpa* and lowest yields came from *P. eucalyptus* (a selection of *P. serotina* according to Houtzagers). Against the high cellulose content of *P. nigra* (48.79%) must be set the fact that the species is not very suitable for afforestation. The strength properties of the pulps were satisfactory and surpassed those of Beech. [Cf. *For. Abstr.* 11 (No. 345).]

468. MCCARTHY, J. L., and HIBBERT, H. **Multistage bleaching of kraft pulp.** *Pulp Paper Mag. Can.* 50 (5), 1949 (88-93). 11 refs.

The multi-stage bleaching of kraft pulp with aqueous solutions of chlorine was studied. It

was found under comparable conditions: (a) that as increasing proportions of chlorine are permitted to react in the second stage, the chemical and physical characteristics of the treated cellulose become less desirable although the degree of whiteness is improved; (b) that increasing the temperature of the second-stage reaction mixture brings about an increase in the degree of cellulose whiteness and in the rate of reaction, but the degradation of the cellulose proceeds to a greater extent; and (c) that when the alkalinity of the second-stage reaction mixture is raised from pH 6.0 to 9.5, an improvement is observed in the quality and whiteness of the cellulose, although the rate of reaction is diminished.

469. KINGSBURY, R. M., SIMMONDS, F. A., and LEWIS, E. S. **Bleaching groundwood pulps with hypochlorites.** *Pulp Paper Mag. Can.* 50 (5), 1949 (98-102). 7 refs.

Results of bleaching experiments made at the Forest Products Laboratory, Madison, on groundwood pulps from 13 hardwoods, 6 softwoods, and a mixture of 6 hardwoods alone and in mixture with Eastern White Pine, show that calcium hypochlorite is a satisfactory bleaching agent for the hardwood pulps, but probably is not satisfactory for the softwood pulp. In general, the brightness of the hardwood pulps was increased to the range of 70-79% with 10% available chlorine. Upon exposure to carbon arc light, the recession in brightness ranged from 4 to 11 points. Bleached pulp yields were 98-100% of the unbleached pulp. The only consistent effect of the bleaching on drainage and strength properties was an increase in tensile strength. Pulps from mixtures of hardwoods can be bleached satisfactorily with hypochlorite, and the brightness of the mixtures will be proportionate to that obtained on pulps from the individual woods. Although the Eastern White Pine pulp did not respond satisfactorily to hypochlorite, a 50/50 mixture of it and the mixed hardwood pulp was bleached to about 70% brightness with 10% available chlorine. Essentially the same result was obtained, however, by blending bleached mixed hardwood pulp with unbleached Pine pulp. This procedure would be the more economical of the two. *From authors' summary.*

470. REICHERT, J. S., and PETE, R. H. **Peroxide bleaching of groundwood.**

Recent developments and commercial status. *Pulp Paper Mag. Can.* 50 (5), 1949 (103-12). 60 refs.

A comprehensive summary, giving a history of the peroxide process, and descriptions of (a) the chemistry of peroxide bleaching, (b) equipment for groundwood bleaching, (c) operation of the bleaching process, (d) variables in the bleaching process, (e) applications of the bleached pulp, and (f) a bibliography of pertinent literature and patent references. *From authors' abstract.*

471. CROSSLEY, T. L. **Fungus infection in ground-wood pulp.** *Pulp Paper Mag. Can.* 50 (4), 1949 (85-6).

Bales of 55% air-dry pulp imported from Sweden and stored for 6 months, gave trouble in the beaters by failing to disintegrate. Three types of fungus had developed in storage:— (1) a black fungus, identified as one of a group of saprophytic *Torula*, (2) an unidentified pink kind and (3) a brown kind closely resembling *Cadophora obscura*. The brown fungus was accompanied by a brown stain, thought to be tannic, or a related acid. Source of the infection was probably strips of wood, chiefly Birch, used to reinforce the edge of the bales. Results from some standard tests on the spoiled pulp are compared with results from typical news groundwood. It is concluded that:— (1) wooden baling strips should be avoided or creosoted, (2) pulp at 55% air-dry is too wet for prolonged storage, and (3) pulp showing signs of infection should be used as quickly as possible.

472. HÄGGLUND, E., and WEBJÖRN, B. **Über die Härte von Zellstoffen. [On the hardness of pulp.]** *Svensk PappTidn.* 52 (6), 1949 (131-7). 15 refs. [G.sw.e.] P.R.

The hardness of pulp, measured by its ability to be beaten, is shown to be determined not by the lignin content, but by the content of low polymerized wood polyoses.

33.32.2. Paper Manufacture

473. **Higher yields through curlation.** *Woodl. Wld.* 2 (4), 1949 (8).

Price Brothers & Co., Ltd., Kenogami, Quebec, have developed a new method for processing pulp for paper. A curled effect is brought about by causing nodules or 'crumbs' of pulp to roll in changing directions between

two surfaces which compress the nodules as they roll. This mechanized action is applied by the 'curlator', which first dehydrates the slush pulp until the nodules can be formed. 'Curlation' gives a 10% increase in yield and also a 10% saving in steam and chemicals. The process also softens hard pulps. Other improvements are improved appearance of paper, increased stretch properties, and greater stability of sheet surface.

33.32.3. Wallboards, Fibreboards, etc.

474. MORGAN, J. T. **The production of wood chips for coarse fiber in the Central States Region.** *Tech. Pap. Cent. St. For. Exp. Sta. No. 111*, 1949. pp. 31.

Gives some account of the manufacture of roofing felt, which provides a new use for coarse wood fibre, and then analyses in detail the relative cost of thinnings and sawmill waste as a raw material for this purpose in the Central States.

475. [ROSE, H.] **Wood waste into building materials.** *Wood Forum looks at economics of board and block production.* *Timb. & Plyw.* 96 (2492), 1949 (640, 642, 646). P.R.

Summary of a paper and discussion on uses of wood waste in Europe and the U.S.A., and possibilities of its increased use in Great Britain.

476. SCHAFFER, R. J. **The manufacture in Germany of building materials from wood-waste.** *Final Rep. Brit. Intell. Obj. Sub-comm. No. 1846, Item No. 22*, [n.d.]. pp. 85. P.R.

Twenty firms were visited. The manufacture of resin-bonded and lignin-bonded wood-waste boards, and sawdust cement and wood-concrete products is described. Production was hampered by shortage of synthetic resins and Portland cement.

477. **Hardboard production in Sweden.** *Timb. & Plyw.* 96 (2498), 1949 (905-6). P.R.

Describes the manufacture, from Spruce and Pine chips, and the moisture-conditioning process, of Katrinite hardboards.

478. GRONDAL, B. L., and ERICKSON, H. D. **Wallboard from wood.** *W. Cst. Lumberm.* 76 (2), 1949 (130-1).

Describes plant and processes used by some 12 hardboard manufacturers in U.S.A.

479. FAHRNI, F. **Manufacture of compound compressed plates.** *Brit. Patent No. 608,252, Dec. 27, 1945. Brit. Abstr. B1*, Feb. 1949 (156). P.R.

Wood waste from veneering processes or furniture manufacture is split to form chips (5-50 mm. long, 3-10 mm. wide and 1-5 mm. thick). These are mixed after treating with 2.5% of paraffin and drying to 5% of H₂O, with 3.5% of a binder, e.g. urea-formaldehyde condensate, a hardening agent and H₂O, to form a layer which is interposed between 2 layers comprising dust-free, thin flat wood waste (from the planing of white softwood), compounded with 14% urea-formaldehyde condensate and 18% H₂O, followed by compressing (at 120-50°/5-25 kg. per sq. cm.) to form a plate.

480. Chapas de fibras de madera para construcciones, parquet y muebles. [**Wood fibre board for building, flooring and furniture.**] *Maderil, B. Aires* 21 (6/8; 9), 1949 (21-2; 21-3). [Span.]

Some general information on the manufacture of fibreboard with special reference to 'Holzerit' in which sulphite waste liquor is used as a bonding agent after the sugar has been extracted. Data on some properties of 'Holzerit' and details of production costs in Switzerland are included.

481. ÖGLAND, N. J. **The swelling and shrinkage of hard wood-fibre plates. I.** *Transl. For. Prod. Aust. [n.d.]*. pp. 4 + 4 gphs., 1 tbl. Transl. by G. L. Amos from *Svensk PappTidn.* 51 (16), 1948 (357-60).

Cf. *For. Abstr.* 10 (No. 2068).

482. ÖGLAND, N. J. **Hårda träfiberskivors svällning och krympning. 2. [The swelling and shrinkage of wood-fibre hardboards. 2.]** *Papp. Trävarutidskr. Finl.* 31 (4), 1949 (57-60). 6 refs. [Sw.e.] P.R.

Describes a series of experiments to find the effect on shrinkage and swelling of hardboard of temperature, density of the board, and nailing. The results, given in graphs and tables show that:—(1) at a given relative humidity, increase in temperature corresponds with a decrease in swelling in the thickness of the board but that swelling and shrinkage in the length are independent of temperature; (2) increase in density corresponds with an increased swelling in the thickness, but swelling in the length

is practically unchanged; and (3) nailing does not eliminate swelling and shrinkage.

483. YOUNGQUIST, W. G., and MUNTHE, B. P. **The effect of a change in testing speed and span on the flexural strength of insulating and structural fiberboards and a proposed new method of test.** *Rep. U.S. For. Prod. Lab., Madison No. R1717*, 1948. pp. 13 + 1 photo; 1 dgm., 7 gphs., 6 tbls. P.R.

33.32.4. Plastics

484. BROWN, G. P. **Production of artificial wood.** *Brit. Patent No. 598,553*, 1948. *Abstr. in Timber News* 57 (2119), 1949 (199).

A synthetic resin, preferably thermo-setting, is mixed with sawdust and the impregnated sawdust is then mixed with wood waste other than sawdust to form a mass; this is submitted to heat and pressure to form boards, blocks or other desired shapes. A fireproof material is made by the addition of asbestos waste. It is claimed that the material is extremely strong and hard and yet capable of being bored, nailed and sawn.

485. KINNEY, L. C., and FERENGE, G. G. **Research in resin impregnated fiber for low-cost furniture.** *Frontier, Chicago* 11 (4), 1948 (3-6, 18-21). D.S.I.R.

In pilot-plant manufacture of chairs, unbleached kraft pulp was broken down in a water suspension and pre-forms were made on felting dies, combining chair back and seat in one piece. After drying the pre-forms were impregnated with resin solution and either pressed or cured in an oven. Both pressed and unpressed materials were attractive in appearance and had good strength properties. Costs were very low.

486. STETSON, R. A. **Crack fillers.** *Soap* 25 (3), 1949 (127-9, 131, 153). 17 refs. P.O.

Gives formulae for the manufacture and notes on the use of crack-filling compounds, including those with sawdust or wood-flour base.

33.33. Manufacture of Textiles and Cellulose Derivatives from Wood

487. **Low-substituted fibrous products of the alkylation of cellulose.** *Transl. Inform. Serv. Coun. sci. industr. Res., Aust. [n.d.]*. pp. 8 + 1 dgm. 13 refs. Transl. by

M. Slade from *Zhurnal prikladnoy Khimii* 20 (11), 1947 (1185-90).

488. SCHUR, M. O., and MCMURTRIE, D. H. **Nitration of wood pulp. Influence of the physical condition of the pulp and of the species of wood.** *Paper Tr. J.* 127 (13; 14), 1948 (51-8; 39-45). 28 refs. P.R.

Studies of coniferous pulp to determine the effect of different species on suitability for use as substitutes for cotton linters in smokeless powders, indicate that the behaviour of a pulp during manufacture will be more favourable the lower the number of fibres per g. of un-nitrated pulp; thus such species as New England Spruce and Balsam Fir, with relatively slender fibres, are less suitable than those with thicker fibres. Manufacture is favourably affected if a sufficiently strong solution of NaOH is used in the purification of the wood pulp to reduce the packing tendency of the fibres.

489. **Bamboo pulp: its possibilities for rayon manufacture.** *Fibres, London* 8 (3), 1947 (82-4). L.S.

Bamboo pulp has been used in India for the last 20-30 years for making a variety of papers. Investigations at the Technological Laboratory of the Indian Central Cotton Committee have shown that certain species of Bamboo can give a high yield of cellulose [cf. *For. Abstr.* 7 (No. 1302)]. Eetta Bamboo gives by the sulphate process a pulp containing 92.66% of a cellulose. A method patented in the U.S.A. uses a hydrotropic solvent, Na xylene-sulphonate, for making Bamboo pulp. The Bamboo is cut, crushed and dried, and then digested by means of a 30-50% solution of aqueous Na xylene-sulphonate, at about 160° C. for 6 hours and at 180° C. for 7-8 hours. After digestion the pulp is washed in a solution of about 20% Na xylene-sulphonate and bleached. The lignin can be separated from the digestion liquor by adding water and the liquor can be used again. A yield of 46% of unbleached pulp was obtained by this process from *Bambusa tulda* and 42% from *Phyllostachys bambusoides*. The pulp has a high cellulose content and is claimed to be suitable for rayon manufacture.

33.36. Wood Finishes. Preservation of Wood. Seasoning and Drying

490. **Evaluation of finishes for Douglas Fir plywood.** *Official Digest, Federation of*

Paint and Varnish Production Clubs, Philadelphia No. 276, 1948 (64-77). 20 refs. L.S.

Presents the results of several selected physical tests of 19 sealers on exterior-grade 3-ply Douglas Fir plywood. The sealers examined were 12 varnish types, 4 alkyl types and 3 pigmented varnishes.

491. MATAGRIN, A. Méthodes nouvelles de protection des bois d'oeuvre. Stabilisation des formes et dimensions. Défense contre rongeurs, insectes et taretts. [New methods of protecting timber. Seasoning. Protection against rodents, insects, and marine borers.] *Rev. int. Bois* 15 (136), 1948 (171-6); 16 (139; 141), 1949 (6-11; 51-6). 47 refs. [F.]

A review article, largely of American literature.

33.36.1. Preservation against Attack by Plants and Animals

See also *For. Abstr.* 11 (Nos. 387-8, 543, 575).

492. List of publications on wood preservation. *Rep. U.S. For. Prod. Lab., Madison* No. R704, 1948. pp. 29. P.R.

493. Tropic proofing: protection against deterioration due to tropical climates. H.M. Stationery Office. 1949. pp. 32. 6 refs. [Ministry of Supply and Department of Scientific and Industrial Research.] Price 9d. P.R.

Includes sections on fungus and insect attack generally, and on wood, with notes on protective treatments and a list of timbers resistant or very resistant to fungi and termites.

494. LINDGREN, R. M. The protection of wood products against insect and fungus damage. *South African Industrial Chemist, Johannesburg* 1 (3; 4), 1947 (58-60; 65-9). D.S.I.R.

495. WALTERS, C. S. A method of analyzing the penetration of light-colored oil-soluble wood preservatives. *For. Note Ill. agric. Exp. Sta.* No. 1, 1948. p. 1. 1 ref. P.R.

496. REAMER, T. E. (to Shell Development Co.). Chlorinated paraffin wax amines as fungicides and bactericides. *U.S. Patent* No. 2,448,910, Sept. 7, 1948. *Chem. Abstr.* 43 (1), 1949 (349). P.R.

Relatively high-molecular aliphatic or alicyclic chloramines are effective fungicides and bactericides for textiles, for wood preservation, soil fumigation and seed and plant protection.

497. ESTRADE, M. J. Procédé de préparation d'une composition antiseptique et d'injection des bois à l'aide de celle-ci. [Method of preparing a preservative composition and impregnating wood with it.] *Fr. Patent* No. 937,278, Aug. 12, 1948. [F.] *Abstr. in Rev. Bois Appl.* 4 (3), 1949 (32).

Two preservatives, one a solution in water or ammonia, the other an oil, are mixed in form of an emulsion and applied to the wood (especially telegraph and power transmission poles) by pressure treatment in a closed tank. The aqueous or ammoniacal solution is used in such concentration as to be equal in density to the oil. A suitable mixture for the emulsion is a solution of $ZnCl_2$ in water, with creosote, in the proportion 10 : 1.

498. BOND, R. W. Interior trim from Eucalypt sapwood [: preservation against Lyctus attack.] *For. Prod. News Lett. C.S.I.R. Aust.* No. 170, 1949 (1-2).

499. [Borax as a wood preservative.] *Rep. Qd. For. Serv.* 1947-8, 1948 (17).

Tests have been carried out with borax as a possible substitute for boric acid which has the disadvantage of corroding vats and being incompatible with certain fungicides. It has been found that borax can be used with fungicides, gives the desired immunity to borers, and permits the use of sheet steel instead of copper for vat linings, which effects a considerable economy.

500. COKLEY, K. The use of borax as a Lycticide in the treatment of susceptible timbers. *Aust. Timb. J.* 14 (11), 1948 (734, 737-8, 745, 747, 749, 751). 6 refs.

Boards from 32 Australian species were treated by the hot immersion process in a discoloured solution of alkaline borate to investigate the staining effects. The solution, of 2% boric acid, had been in use for 21 months, was well charged with wood extractives, and had been made alkaline to a pH greater than 8.0. Surface stain from the discoloured solution was moderate and removable by dressing. No stain occurred when freshly prepared solutions were used. Penetration was satisfactory. The alkaline reaction extended only to a depth of

0.03 in. into the timber, the pH range at a greater depth being markedly acid, implying a reaction between the alkaline salts and acidic substances either contained in the wood, or formed from it by the effect of heat and moisture. The effects of steel containers in treatments using alkaline borates, principally borax, were also studied. It was concluded that the use of ferrous materials in the construction of the plant was satisfactory, and no ill effects result from prolonged immersion of veneer in contact with ferrous material in borax solution.

501. **Boric acid substitutes.** *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 3 (10/12), 1948 (11-3).

Borax has been found the most satisfactory substitute for boric acid, NaF and pentachlorophenol not being recommended for use on a commercial scale for the immunization of *Lyctus*-susceptible timber.

502. VRIJDAGH, J. M. À propos des dégâts occasionnés au Limba par le *Lyctus brunneus*. [On the damage done to Afara (*Terminalia superba*) by *Lyctus brunneus*.] *Bull. Comp. Vente Bois congol.* 3 (24; 25), 1948 (8-10; 5-8). [F.] P.R.

Summarizes the literature on the use of pentachlorophenol as a wood preservative and recommends its use in the case of *Terminalia superba*. Cf. *For Abstr.* 11 (No. 388).

503. **Pentachlorophenol treating plants for farm communities.** *Down to Earth, Midland, Mich.* 4 (2), 1948 (8-10). I.M.I.

504. BEHR, E. A. **Application of pentachlorophenol as soil poison [against termites] and wood preservative.** *Pests* 17 (3), 1949 (19-20, 22). D.S.I.R.

505. SNYDER, T. E., and ZETEK, J. **Effectiveness of wood preservatives in preventing attack by termites.** *South African Timber Trades Journal, Johannesburg* 2 (10-12), 1948 (6-7, 9, 11, 12-4; 13, 15; 9, 11-3); 3 (1), 1948 (17-9). 13 refs. I.F.B.

506. ALLOUARD, P. La protection du bois contre les termites et la pourriture par des procédés simples et peu coûteux. [The protection of timber against termites and decay by simple and inexpensive means.] *Bois For. Trop.* No. 8, 1948 (415-26). [F.f.]

Recommends the use of resistant timber and preservatives, and outlines essentials of good building practice.

507. WOLCOTT, G. N. **What to do about Polilla [*Cryptotermes brevis*].** *Bulletin of the University of Puerto Rico Agricultural Experiment Station, Puerto Rico* No. 68, 1946. pp. 29. 5 refs.

Account of termite infestation in Puerto Rico, with lists of resistant and susceptible indigenous timbers, and preservative treatment.

508. PEAKE, F. G. G. **First principles in the protection of timber against insects.** *E. Afr. agric. J.* 14 (3), 1949 (167-73 +16 photos). [Forest Entomologist, Kenya Colony.]

Classifies and describes types of damage done to timber by various E. African insect pests, and recommends control methods.

509. BECHERER, R. H. **Pressure treated plywood.** *Veneers & Plyw.* 43 (5), 1949 (12, 14, 16). P.R.

Exterior-grade plywoods, bonded with phenol- or resorcinol-formaldehyde glues, can be pressure treated with fire-retardant or preservative chemicals without damage to the glue bond. The treating process is described. Results of experiments show that:—(1) when veneers are treated with preservatives before gluing, crystals are formed on the surface of the wood which prevent successful gluing; (2) plywood glued with urea-formaldehyde or casein glues delaminates as a result of pressure treatment; and (3) plywood glued with phenol- or resorcinol-formaldehyde glues, treated after gluing, showed no signs of delamination after weathering for 5 years and was still fire-resistant. Experimental work on suitable fire-retardants shows that normal retentions of 3 lb./cu. ft. of a mixture consisting of 80% chromated $ZnCl_2$, 10% H_3BO_3 and 10% $(NH_4)_2 SO_4$, will render wood resistant to fire, decay and insect attack.

510. 33.36.1 : 33.53. DEDIEU, M. Le poteau de lignes en bois injecté: son avenir. [The future of impregnated electricity cable poles.] *Rev. Bois Appl.* 4 (5), 1949 (29-31). [F.]

Describes methods of impregnation that give satisfactory preservation for electricity cable poles.

511. STACEY, W. A. **35 or more years' life indicated for 6-lb. creosoted wood posts.** *Wood Pres. News* 27 (4), 1949 (44-6, 49-50). P.R.

Results of 4 sets of service tests lasting over 26-35 years are given. The posts, which had been treated to give a retention of 5 or 6 lb. of creosote per cu. ft., were in positions exposed to repeated fires, as well as to decay and termite attack. Of some 1,500 posts, 14 are now unserviceable because of decay, breakage or fire damage. In one instance untreated control posts were badly decayed by the end of 3 years and failed soon after.

33.36.2. Fireproofing

512. HARTMAN, F. A. **Utilization of fire retardant wood.** *Rep. 7th Vt. Wood Prod. Conf.* 1947 (3-11). P.R.

Discusses briefly the chemicals used to make wood fire-retardant, and the qualities and uses of wood so treated.

513. BLACK, G., and SANDERS, H. **Fire retardant paints.** *Product Engineering, New York* 19 (8), 1948 (140-4). L.S.

Comparative tests were carried out on a number of commercial paints, applied to both sides of $\frac{3}{16}$ -in. wood panels which were then exposed to a flame. The tabulated results indicate that (1) paints containing fusible inorganic ingredients are effective as fire retardants; (2) phosphate paints are outstanding and silicate paints good; (3) borax paints are more effective when the borax is mixed in without grinding.

33.36.3. Seasoning. Drying

See also *For. Abstr.* 11
(Nos. 313, 427, 554, 560).

514. DEVINE, J. **The drying of lumber.** *Rep. 7th Vt. Wood Prod. Conf.* 1947 (18-27). P.R.

515. STEVENS, W. C. **The effect of piling on the distortion of timber.** *Timber News* 57 (2118), 1949 (148, 151). [Forest Products Research Laboratory, Princes Risborough.]

Makes recommendations on methods of piling which reduce the danger of distortion during seasoning.

516. **Approximate air seasoning and kiln drying periods for inch lumber.** *Tech. Note U.S. For. Prod. Lab., Madison* No. 233 (rev.), 1948. pp. 4. P.R.

Gives tables showing the days required for drying common American hardwoods and softwoods to different moisture contents.

517. NEALE, E. W. **Treatment of timber.** *Brit. Patent* No. 604,736, Jan. 9, 1946. *Brit. Abstr. BI*, Jan., 1949 (108). P.R.

Sawn timber is dried more rapidly and without distortion or cracking by first cooling it for not less than 2 days throughout its mass to less than 0° [C.] and then heating it (e.g. to 60°) to drive off the moisture.

518. VILLIERE, A. Possibilités d'amélioration des séchoirs à bois. [Possible ways of improving seasoning kilns.] *Rev. int. Bois* 16 (140), 1949 (27-32). [F.]

Discusses in some detail possible lines of improvement, based on practical experience, and concludes that the most promising are in:— (1) the construction of the drying chamber, particularly the inside covering of its walls; (2) the distribution of air in the kiln; and (3) the control apparatus. It is concluded that kilns of a moderate capacity (e.g. 10 cu.m.) are more economical to operate and easier to design than large ones.

519. SALOMON, R. L'électricité dans le séchage des bois, la ventilation, l'éclairage et le chauffage des ateliers. [Electricity for seasoning wood and for ventilating, lighting and heating workshops.] *Rev. Bois Appl.* 4 (5), 1949 (10-4). [F.]

Includes descriptions of electric moisture gauges, and of the 'Pigral' method of maintaining constant temperature and humidity by variable resistance. This French automatic regulator is claimed to be cheaper and simpler than the American types.

520. BURNS, A. F., and HYDE, W. S. **Gas-fired lumber drying kilns.** *Industrial Gas, Vermont* 27 (2), 1948 (13, 25-6). D.S.I.R.

Gas heating can be used for either natural- or forced-draught kilns. A low-pressure gas is used. Gas demand will vary with the size of the kiln, the species of timber and its moisture content, but the average operating demands for kilns 22 × 60 × 12 ft. and 22 × 120 × 12 ft. are estimated at 1,500 and 2,800 cu. ft., and peak

demands, which occur immediately after the unloading and reloading of the kilns, at 2,200 and 3,500 cu. ft. respectively. Little information is available on operating costs; at present they vary from 1,000 to 4,000 cu. ft. of gas per 1,000 bd. ft. of timber dried and they are expected to settle finally in the neighbourhood of 2,500 cu. ft./1,000 bd. ft.

521. SHARP, F. H. **Airflow in kilns.** *Timber News* 57 (2119), 1949 (177-8).

The use of a reversing switch, to change the direction of the air flow in the kiln every 20 minutes, was found to give more uniform atmospheric conditions. The total drying time was not much shorter, but the quality of the seasoned timber was improved.

522. LOUGHBOROUGH, W. K. **Chemical seasoning of Southern species.** *Sth. Lumberm.* 178 (2231), 1949 (40, 42, 44, 46, 48, 50, 52, 54).

Discusses losses incurred from poor seasoning methods, and the general principles, methods and economics of chemical seasoning, with special reference to a patent, buffered sodium-chloride agent, 'Saligna', which is claimed to be less corrosive than common salt.

523. MILLER, D. G. **Seasoning wood by dielectric heating.** *Timber News* 57 (2117; 2118), 1949 (103-4, 109; 151).

524. DALLAS, J. E. **The application of infra-red heating to the drying of veneers in the plywood industry.** *W. Cst. Lumberm.* 76 (2; 4), 1949 (92, 94; 92, 96). 9 refs.

The failure of the infra-red process in veneer drying is mainly due to inability to adapt the equipment to the purpose, particularly in obtaining an equal distribution of the energy. Some types of drier, and problems connected with them, are discussed. The most efficient infra-red veneer drier is a 'booster', or supplementary drier, added to the conventional convection drier and treating the veneers after they are partly dried. The veneers must leave the conventional drier at a temperature of at least 212° F. and 20% moisture content. Some problems of installation—distance of 'booster' from the first drier, lamp wattage and spacing, and roller mechanisms—are discussed.

525. HUDSON, M. S. **Vapor-drying of Oak cross ties.** *Repr. from Appendix to Bulletin of Committee on Wood Preservation of*

American Railway Engineering Association No. 478, 1949 (403-18). P.R.

Further data on vapour drying and pressure treatment processes.

[*Cf. For. Abstr.* 9 (Nos. 1758-63).]

526. HUBER, J. **Drying of wood (for wood-gas producers).** *Bauwelt, Berlin* 21, 1947 (413-6). *Fuel Abstr.* 4 (4), 1948 (39). P.R.

Discusses methods for the preliminary drying of wood so as to increase the efficiency of the process for wood-gas production.

33.37-8. Destructive Distillation. Charcoal and By-Products. Use of Wood and Charcoal for Gas Manufacture

See also *For. Abstr.* 11 (Nos. 368, 526).

527. BERGSTRÖM, H. **Milans tändning. [Igniting beehive-type charcoal kilns.]** *Skogen* 35 (24), 1948 (290). [Sw.]

Gives details of the construction and operation of charcoal kilns having a radial channel at the bottom, through which the firing of the charge is done, and a bottom flue and chimney to control the draught so as to heat the bottom of the charge in the shortest possible time.

528. ZANKL, W. **Neuere Erkenntnisse und Erfahrungen bei der Entgasung von Holz. [Fresh light on the gasification of wood.]** *Gas- und Wasserfach, Stuttgart* 88 (6), 1947 (180-5). 22 refs. [G.g.] D.S.I.R.

Summarizes research on factors affecting the output and quality of gas from wood. Gasification at high temperatures gives a better yield and a more satisfactory gas. There is little difference in quality, quantity and chemical composition in the gas from hardwoods and softwoods. The calorific value of gas from hardwoods is not affected by the size of the pieces of wood; gas from softwoods cut in small pieces has a higher calorific value than that from large pieces. Decayed wood gives a poor yield and an unsatisfactory gas.

529. **Gas plant at the fertilizer factory, Travancore.** *J. sci. industr. Res., India* 7 (10), 1948 (469-71). D.S.I.R.

The producer-gas section of this plant handles about 300 tons of wood in 24 hr. and provides for the recovery of tar, acetic acid and water vapour.

530. ENKVIST, T. Smörolja från trätjärar och tallolja. 4. Kok med katalysatorer på stubbugnstjärar. [Lubricating oil from wood-tar and tall oil. 4. Cooks of oven stump tar in the presence of catalysts.] *Papp. Trävarutidskr. Finl.* 31 (3; 4), 1949 (44-7; 61-8, 75). 22 refs. [Sw.e.] P.R.

33.39. Manufacture of Sugar, Oils, Alcohol, and Miscellaneous Chemical Products from Wood

See also *For. Abstr.* 11 (Nos. 571, 579-80).

531. THORBJÖRNSSON, B. Saccharification of cellulose by means of formic acid. *Transl. Inform. Serv. Coun. sci. industr. Res. Aust.* 1949. pp. 22 + 3 gphs., 10 tbls. Transl. by E. Selman-Towt from *Svensk Papperstidning* 51 (9), 1948 (206-13). P.R.

Cf. *For. Abstr.* 10 (No. 1307).

532. TYLER, R. G. Fodder yeast production from sulfite waste liquor. *Sewage Works Journal, Lancaster, Pa.* 20 (3), 1948 (516-24). 2 refs. D.S.I.R.

The propagating process is described, with tabulated operating data. Average production of yeast was 8.7 g./l. of reducing substances, or 0.44 g. yeast per g. sugar. Better yields were obtained from mixed than from pure cultures of *Torula utilis*. Estimated costs using the propagator described are about 3 cents per lb.

533. ENEBO, L. Några försök över utbytet vid sulfitsprittjäsning. [Experiments on the yield from fermentation of sulphite liquor.] *Svensk PappTidn.* 52 (5), 1949 (101-6). 10 refs. [Sw.e.g.] P.R.

534. LASSENIUS, T. Sulfitsprittillverkningen i statistisk belysning. [The manufacture of sulphite alcohol seen statistically.] *Papp. Trävarutidskr. Finl.* 31 (7a), 1949 (4-9, 10). 21 refs. [Sw.e.] P.R.

Gives detailed figures for production in Sweden, Finland, Norway and Germany.

535. HARRIS, E. E. Wood molasses for stock feed. *Rep. U.S. For. Prod. Lab., Madison No. R1731*, 1948. pp. 9. P.R.

Molasses from hardwoods and softwoods produced at the Madison pilot plant was supplied to agricultural experiment stations for stock-feeding tests. It appeared to be palatable and nutritionally satisfactory as feed for

cattle, sheep, pigs and poultry in proportions varying from 2 to 30%. Grass silage preserved with wood molasses had improved keeping qualities and was more palatable to stock. Further experiments are planned.

536. HASSELSTROM, T. On Pine tree resenes [the non-saponifiable constituents present in the turpentine-free resinous extractives] in the biogenesis of the resin acids. *Paper Tr. J.* 128 (7), 1949 (17-21). 48 refs. P.R.

33.4. Converted Structural Timber

See also *For. Abstr.* 11 (Nos. 498, 555).

537. Portes 'Treillis'. ['Treillis' doors.] *Rev. Bois Appl.* 4 (4), 1949 (37). [F.]

Describes a flush door with lattice core. Tests carried out by the Institut National du Bois for moisture content and mechanical strength gave satisfactory results.

538. Corrugated honeycomb - core panels. *Fibre Contain.* 34 (2), 1949 (24, 26, 31). P.R.

Tests at Madison on an outdoor experimental housing unit with roof, wall, floor and door panels of corrugated cores with facings of plywood, veneer and aluminium, indicate that these panels are suitable for building use. In laboratory tests the panel facing giving best results was a single $\frac{1}{8}$ -in. Douglas Fir veneer with paper overlays.

539. NICHOLS, W. Plywood heating panels. *Timb. & Plyw.* 96 (2495), 1949 (768, 770). P.R.

Describes a patented plywood panel in which an electrical-resistance heating element is interwoven in a fabric, and the fabric assembly impregnated with a synthetic resin, then hot-pressed between wood veneers of any desired species. The heating element is thermostatically controlled. The panels are suitable for use in houses, public transport vehicles, private cars and ships.

33.5. Pitprops. Sleepers. Poles and Other Roughly Converted Wood

See also *For. Abstr.* 11 (Nos. 381, 510-1, 525, 555, 575).

540. HENSHAW, H. The use of timber in mining. *Timb. Developm. Ass., Lond.* 1949. pp. 84. 3 refs.

Describes with illustrations the different forms of timbering in coal mines, and gives details of species used, sizes, seasoning, fire-proofing and preservation of mining timbers.

541. ELKIN, J. E. **Use of timbers used to protect working face for roof support of haulage roads.** *Coal Mining, Pittsburgh* 24 (12), 1947 (14-6). D.S.I.R.

Describes with diagrams and photographs a method of roof timbering which does away with the use of timber legs in the working places and haulages.

542. **Commodity reports: Railway sleepers.** *Unasylva* 3 (2), 1949 (80-85).

Statistics of imports, exports and requirements of railway sleepers by countries.

543. MUELLER, L. A. **Cottonwood railway tie test completed.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta.* No. 67, 1948. pp. 2.

In 1910 the Northern Pacific Railway Co. installed 261 pressure-croosoted Cottonwood (*Populus trichocarpa*) sleepers on a branch line in order to determine the suitability of this species for the purpose. A final inspection in 1947 showed that 151, or ca. 58% of the original sleepers were still in service. The 110 which had been removed, had had an average life of 28 years, and the weighted average of all sleepers in the test, including estimated additional service at the time when it closed, was 35 years.

33.6. Packing Boxes, Crates, etc.

See also *For. Abstr.* 11 (No. 555).

544. SALONE, J. Les emballages en bois. [The use of wood in packing.] *Rev. Bois Appl.* 4 (3), 1949 (7-14, 26). [F.]

Discusses the technical and commercial sides of wood in packing in France and (more briefly) in Europe and the U.S.A., and compares the use of wooden and cardboard boxes.

33.7. Firewood

See also *For. Abstr.* 11 (No. 526).

545. JOUARD, P. Appareils de chauffage au bois. [Wood-burning stoves.] *Rev. Bois Appl.* 4 (3), 1949 (15-6). [F.]

546. FONDERIES NESTOR MARTIN, SOCIÉTÉ ANONYME, BELGIUM. **Wood burning stoves.**

Brit. Patent No. 595,395, Dec. 3, 1947. Price 2s. *Abstr. in Timber News* 57 (2117), 1949 (122).

Describes a stove designed for armies on campaign.

33.8. Other Manufactured Products

See also *For. Abstr.* 11 (Nos. 416, 429, 555, 558).

547. NICHOLS, W. **Plywood in aircraft construction—2-5.** *Timb. & Plyw.* 96 (2487; 2489; 2491; 2492), 1949 (419-20, 422; 509-10, 512; 593-4; 638, 646). P.R.

[Cf. *For. Abstr.* 10 (No. 2819).] Part 2 continues discussion on the 'stressed skin' technique in the use of plywood for the fuselage sides, and deals with its application as a wing covering. Parts 3-5 deal with the use of moulded plywood for fuselage and wings; the Horsa glider; and Balsa-plywood sandwich applications.

548. FISCHER, G. I. **The forest moves to the sea [: design and qualities of plywood boats].** *Rep. 7th Vt. Wood Prod. Conf.* 1947 (28-31). P.R.

549. IRVIN, D. B., and JOHNSTON, D. R. **Lignum Vitae in shipbuilding [: its use as a lining for stern bushes].** *Wood* 14 (3), 1949 (74-6).

550. BANNINGER, F. **Manufacture of wooden rods for fishing rods and ski sticks, etc.** *Brit. Patent* No. 601,432, May 5, 1948. *Abstr. in Timber News* 57 (2118), 1949 (166).

Describes a method of manufacturing wooden rods in which the rods are profiled to their required shape and heat-dried. They are then impregnated with a solution of soluble phenolic or amino resin in methyl alcohol or methyl ethyl ketone and, after air-drying, finally hardened by being subjected to pressure transversely to the grain of the wood.

551. SCHWARTZ, J.-R. **Emplois du bois dans la construction électrique. [The use of wood in electrical structures.]** *Rev. Bois Appl.* 4 (5), 1949 (32-4). [F.]

Discusses the dielectric properties of dry wood, and describes impregnation and varnishing treatments to prevent increase of humidity. Improved woods, because of their greater

stability, are suitable for use without further treatment.

33.9. Grading [including Standard Specifications] and Storage of Converted Timber

552. DESCH, H. E. **Grading Empire hardwoods.** *Timb. & Plyw.* 96 (2495), 1949 (772, 774, 776). P.R.

Quotes and discusses draft rules for grading Malayan timbers.

553. PRICE, A. W., and HOYLE, R. J. **Hardwood lumber inspection.** *Tech. Publ. N.Y. St. Coll. For.* No. 70 (rev.), 1949. pp. 48. Notes on grading rules.

554. NELSON, L. A. **How the grader looks at seasoned lumber.** *Timberman* 50 (5), 1949 (57-8).

General principles of grading such lumber.

555. **Cut-stock possibilities in wood-consuming industries in midwestern states.** *Rep. U.S. For. Prod. Lab., Madison* No. D1724, 1948. pp. 29 + 1. P.R.

Lists standard dimensions for cut stuff used in the manufacture of prefabricated houses, fittings, household equipment and a miscellaneous group including toys, boxes and crates, ladders and fencing, and indicates some suitable species.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. Vegetable Products

See also *For. Abstr.* 11 (Nos. 307, 406-7).

34.21. Fodder Grass and Grazing. Forest Litter

See also *For. Abstr.* 11 (Nos. 596-9, 766).

556. URBAS, J. Pridobivanje in poraba stelje. [Bedding for livestock: its collection and uses.] *Gozd. Vestn.* 5 (3), 1946 (53-62). [Sloven.]

Shortage of straw forces the Slovene peasant to rely greatly on forest litter, which is collected between autumn and spring. Beech, Chestnut and Spruce leaf litter are best, but bilberries, heather, mosses and ferns (whose removal

benefits the forest) are also taken; where even these are deficient, much damage has been done by the removal of live branches. All collection operations need careful watching.

34.24. Tanning Materials. Cork. Bark Products

See also *For. Abstr.* 11 (Nos. 110, 184, 434, 466).

557. KUTATELADZE, I. G., and MUDZHIRI, K. S. **Making tannins from Smoke Tree and Sumac.** *Farmatsiya* 9 (5), 1946 (1-7). *Chem. Abstr.* 41, 1947 (7148). P.R.

Describes a method of obtaining tannin that gives a yield of approximately 3.5% calculated on leaf weight.

558. **Bottle corks.** *Rep. For. Dep. Brit. Guiana* 1946, [1947?] (5).

Tests were carried out on the suitability of Corkwood [*Pterocarpus* sp.] for making bottle corks. Owing to discoloration of the test fluids by tannins (?) in the wood, it seems unlikely that this species will prove suitable.

559. RETTIE, J. C., and SIMMONS, F. C. **Estimates of bark supply in the Northeast.** *Paper Tr. J.* 128 (15), 1949 (21-3). P.R.

560. **The drying of bark: a preliminary report.** *Paper Tr. J.* 128 (18), 1949 (21-2). Also in *Bull. Ntheast. Wood Utiliz. Coun.* No. 25, 1949. P.R.

Describes briefly some of the methods used for reducing moisture content in bark and outlines a possible series of studies on bark utilization.

561. JENSEN, W. **The connection between the anatomical structure and chemical composition and the properties of outer bark of White Birch.** *Papp. Trävarutidskr. Finl.* 31 (7), 1949 (113-4, 116 + 14 photos). 1 ref. [E.]

The results of chemical extraction and of microscopic and microphotographic examination of the bark structure are discussed and related to some of the known properties of the outer bark: (1) the high calorific value is attributed to the high % of C (71.2) and H (10), which are in turn dependent on the high content of suberin (38.7%) and ether extract (38.1%); (2) the inflammability is attributed to the low moisture content (8.9%) in growing trees in

winter, due to the nature of the cells, which are of waterproof material, free from pores and filled by hydrophobic materials; (3) the flexibility of the outer bark is attributed to the low % of lignin (2.9) and high % of suberin (85.0) in the cell wall; (4) the high resistance to micro-organisms is attributed to the resistance of the suberin and to the antiseptic properties of the betulinal; (5) the high tensile strength in the direction perpendicular and low tensile strength parallel to the length of the trunk is attributed to the orientation of the cells in the former direction; (6) the tendency to split in thin concentric layers is the result of the alternate layers of spring and summer bark, mechanically weaker and stronger respectively.

562. CHATTERJEE, A., and MITRA, S. S. **On the constitution of the active principles isolated from the matured bark of *Aegle marmelos*, Corrêa.** *J. Amer. chem. Soc.* 71 (2), 1949 (606-9). O.R.S.

From the matured bark of *Aegle marmelos*, three crystalline compounds were isolated in a pure state: (1) the alkaloid γ -fagarine; (2) a coumarin which had not been observed before in the free state in nature; and (3) umbelliferone. *From authors' summary.*

563. CHAKRAVARTI, D., and KUNDU, N. **Chemical investigation of the bark of *Prunus acuminata*.** *Sci. & Cult.* 14(1), 1948 (36). 6 refs. [University College of Science and Technology, Calcutta.] D.S.I.R.

34.25. Christmas Trees. Medicinal and Edible Plants

See also *For. Abstr.* 11 (Nos. 328, 570).

564. HUTCHISON, S. B., and HUEY, B. M. **Suggested Montana Douglas-Fir Christmas tree standards.** *Sta. Pap. Nth. Rocky Mt. For. Range Exp. Sta.* No. 18, 1949. pp. 14.

565. CHOPRA, R. N., KAPOOR, L. D., HANDA, K. L., CHOPRA, I. C., and NAYAR, S. L. **Scope for the cultivation of medicinal plants in India.** *J. sci. industr. Res., India* 7 (12), 1948 (527-34); 8 (1), 1949 (14-21). 18 refs. I.H.

Discusses the possibility of cultivating medicinal plants including *Du'oisia* and *Eucalyptus* spp., and *Rhamnus purshiana*. I.H.

566. HIGBEE, E. C., and LEE, A. **Drug and medicinal crops.** Pp. 127-60 (+ 9 photos) in *New crops for the New World*. The MacMillan Co., New York. 1945. L.S.

567. COLLIER, W. A., and PIJL, L. VAN DER. **Over antibiotische werking, speciaal van hogere planten, met nieuwe resultaten bij Indonesische planten. [On antibiotic activity, particularly in higher plants, with some new results for Indonesian plants.]** *Chron. Nat.* 105 (1), 1949 (8-15). 115 refs. [Du.] [Institut Pasteur and Faculteit van Wiskunde en Natuurwetenschap, Bandoeng.] E.M.B.

Reviews the antibiotics already reported in literature, and gives a brief account of the authors' tests of leaf extracts from wild and cultivated Javanese plants. Among the species showing antibiotic activity were:—*Moringa oleifera*, *Punica granatum*, *Thea assamica*, *Psidium guajava*, *Eugenia cumini*, *Terminalia catappa*, *Elaeocarpus ganitrus* and *E. grandiflorus*, *Galphimia gracilis*, *Flueggea virosa*, *Myrica javanica*, *Arrabidaea magnifica* and *Lantana camara*. These all showed activity against *Staphylococcus albus*, but not necessarily against the two other test bacteria *Pasteurella pestis* and *Escherichia coli*.

568. REDEMAN, C. E., WISEGARVER, B. B., and ALLES, G. A. **Characterization of certain alkaloids from *Fagara coco*.** *J. Amer. chem. Soc.* 71 (3), 1949 (1030-4). 13 refs. O.R.S.

569. LI, L. Y., and CHOU, C. Y. **The ascorbic acid content of fruits, vegetables and other plant-parts in Fukien.** *Fukien agric. J.* 10 (1/2), 1948 (1-14). 13 refs. [Chin.c.]

Includes data for fruits of *Zizyphus jujuba* and *Phyllanthus emblica*, which showed the highest content of the 83 species and varieties (representing 11 families) tested, at 383-538 and 283-412 mg. acid/100 g. fresh pulp, respectively.

34.28. Resin. Turpentine. Oils. Gums. Latex. Dye-stuffs, etc.

570. KRISHNA, S., and BADHWAR, R. L. **Aromatic plants of India. Parts III-IV; VIII-IX.** *J. sci. industr. Res., India* 6 (4), 1947 (Suppl. 47-76; 129-60). [Forest Research Institute, Dehra Dun.] D.S.I.R.

[Cf. *For. Abstr.* 10 (Nos. 625, 2159, 2876-7, 2882).] Families dealt with in the parts noticed here are:—(III) Guttiferae, Theaceae, and Dipterocarpaceae; (IV) Malvaceae, Sterculiaceae, Tiliaceae, Erythroxylaceae, Malpighiaceae, Zygophyllaceae and Geraniaceae; (VIII) Meliaceae, Vitaceae, Sapindaceae, Sabiaceae, Anacardiaceae and Moringaceae; (IX) Leguminosae.

571. Harznutzung: Vorträge, gehalten am 12. Mai 1943 anlässlich der VII. Komiteesitzung der Internationalen Forstzentrale zu Berlin. [Resin production: lectures delivered at the 7th Committee Meeting of the International Forestry Centre (C.I.S.) at Berlin, 12 May, 1943.] *Silvae Orbis* No. 12, 1944. pp. iv + 106. 49 refs. [G.]

The subjects reviewed in these lectures are:—Resin production from dead wood, with special reference to the utilization of stumpwood etc. (*L. Moser*; pp. 1-22, 33 refs.); Resin-tapping of Pines in France, with reference to actual practice, experimental techniques, and investigations on factors affecting resin yield of trees and the effect of tapping upon increment and wood properties (*A. Oudin*; pp. 23-37); The organization of resin production in Germany (*R. Ortelge*; pp. 38-45); The status of technique in German resin production from Scots Pine (including notes on the use of 25% HCl as a stimulant) and Norway Spruce (scrappings from wounds caused by deer) (*K. Möbius*; pp. 46-54); and Resin production as a task of European forestry, an attempt to review the economic position and possibilities of resin production in Europe taken as a whole (*H. J. Loycke*; pp. 55-106, 16 refs.).

572. Pejovski, B. Pridobivanje smole v LR Makedoniji. [Resin production in the Republic of Macedonia.] *Gozd. Vestn.* 5 (4/5), 1946 (78-84). [Sloven.]

An illustrated account of the small-scale tapping, mainly of *Pinus sylvestris* and *P. nigra*, which is confined to the mountainous regions of this one province of Yugoslavia. A primitive peasant industry until 1935, its development was started in that year by the Forest Department in a state forest, with headquarters at Skopje, using French and German methods. Resin production, initially 65 tons, rose to 110 tons before 1941. By 1946 the Turpentine Institute at Kapina was working 110,000 channels on an area of 900 ha., yielding some 90 tons

of resin, and buying another 50 tons from the peasants. Possibilities and future plans of the industry are discussed.

573. GAŠPERŠIČ, I. Pridobivanje borove smole v Slov. Primorju. [Production of Pine resin in the coastal region of Slovenia.] *Gozd. Vestn.* 6 (1/2), 1947 (39).

A note on tapping operations started in 1938, first on the French and then (1940) on the German system. Under conditions of the Occupation only half the possible yield was obtained. An improved Slovene system of tapping, was introduced in 1947 [no details given].

574. RYBERG, M. E., BURNEY, H. W., and CLEMENTS, R. A new type of gutter for bark-chipped trees. *Naval Stores Rev.* 58 (52), 1949 (14, 27).

Describes a type of gutter, shaped to follow the course of a spiral around the resin face in bark-depth tapping. It is made with a curvature to fit a 10-in.-diameter tree, when set at an angle of 45° to the axis of the bole. The new gutter has been developed by the Lake City Branch of the Southeastern Forest Experiment Station.

575. SNOW, A. G., JR. Turpentine and poles. *Sth. Lumberm.* 177 (2225), 1948 (276, 278-90).

Pines tapped on two faces by the modern method of bark-depth freshenings plus acid treatment, yield in 3 years the equivalent of 5 years by the old method. The reduced tapping period produces poles of greater diameter and, since the faces are considerably shorter, less of the butt has to be cut off, so that the poles are also longer. Preservative penetration tests showed that in Slash Pine [*Pinus caribaea*], penetration behind the modern face was satisfactory; but faces of Longleaf Pine [*P. palustris*] required to be incised. The reason for this specific difference is not yet known.

576. SCHOPMEYER, C. S. A method for determining the proper time to start acid treatment of turpentine trees. *Naval Stores Rev.* 58 (48), 1949 (16-7, 28).

Describes tests on Slash Pine to find the proper time to begin acid treatment of streaks [freshenings]. Virgin faces were set up, freshened and treated, beginning at fortnightly intervals from Feb. 4 to April 1 inclusive.

Bark-depth streaks $\frac{1}{2}$ in. high were treated with 50% H_2SO_4 on a bi-weekly schedule, and height of 'lightering' [formation of lightwood] above the face, as indicated by discoloration in the killed tissue of the inner bark, was measured 2 weeks after the 1st, 3rd and 5th streaks on trees in each starting-date group. Leader-bud measurements were made at the same time on saplings growing near the tapped trees. Results show that 'lightering' above the treated streaks was not reduced to normal until bud growth had started. The best time to begin freshening and treatment appeared to be after the leader buds had doubled in length.

577. CLARK, C. K., and OSBORNE, J. G. **The properties of Longleaf Pine oleoresin as affected by tree characteristics and management practices.** *Tech. Note Stheast. For. Exp. Sta.* No. 70, 1948. pp. 17.

A study was undertaken jointly by the Southeast Forest Experiment Station of the U.S. Forest Service and the Naval Stores Station of the Bureau of Agricultural and Industrial Chemistry, of the effects of tree characteristics and certain management practices on the grades of rosin and % of turpentine obtained from Longleaf Pine resin and scrape. The tree factors studied were diameter, growth rate and inherent yielding capacity. Experiments with management practices included varying the distance of the face from the lip and comparing the effects of weekly and monthly collection. It was found that the turpentine content of resin was somewhat influenced by the height of the face, the yield of resin, growth and size of tree, but the influence of any one factor was too small to be of consequence. Similarly the turpentine content of resin collected in the rainy season was not materially higher from monthly than weekly collections. No relationship appears to exist between turpentine content of resin and the inherent resin-yielding capacity of the tree. High-grade rosin, however, is associated with low faces and high resin yield. The grade of rosin from resin collected in a wet season was not influenced by the frequency of collection. A low proportion of scrape is obtained from low faces on high-yielding trees. Some practical recommendations based on these results are made.

578. POOLE, H. P., and PATTON, E. L. **Pine gum processing labour and fuel**

costs. *Chemical Engineering, Albany, N.Y.* 54 (8), 1947 (102-3). L.NF.

579. CODONI, J. C., and VALENTE, H. M. **Investigaciones sobre una resina contenida en los 'nudos' del 'Pino Misionero' (*Araucaria angustifolia*). [Investigations of a resin contained in knots of *Araucaria angustifolia*.]** *Publ. tec. Direcc. Inform. Argent.* No. 7, 1948. pp. 16. 10 refs. [Span.]

Presents the results of an analysis of resin extracted from knots of *Araucaria angustifolia*. The resin is suitable for the preparation of alcoholic varnishes for wood and leather, and could be used as a substitute for lac. Varnishes made from 80% *Araucaria* resin and 20% lac gave excellent results.

580. CASADO CALVO, J. A. **La destilación de la madera resinosa. [The distillation of resinous wood.]** *Industria y Química, Buenos Aires* 10 (2/3), 1948 (37-40). 3 refs. [Span.] D.S.I.R.

Describes the process of obtaining resin and resin products from wood by a distillation process. The turpentine and most of the pine oil are first extracted by steam vapour, and the wood is then treated with a solvent (usually a special petroleum fraction) to extract the resin. The suggested lay-out of a plant is illustrated and discussed. [Cf. *For. Abstr.* 8 (No. 409).]

581. WILLIAMS, A. E. **Cashew resins, their use in the manufacture of insulating varnishes.** *Electrical Review, London* 141 (3638), 1947 (244-5). L.S.

Gives some properties of cashew resin varnishes.

582. SUKH DEV and GUHA, P. C. **Studies in the sesquiterpenes. Part V. The essential oil from the oleo-resin of *Hardwickia pinnata*.** *Journal of the Indian chemical Society, Calcutta* 25 (11), 1948 (495-502). [Indian Institute of Science, Bangalore.] O.R.S.

583. ISLIP, R. T. **Essential oils of the British colonies in relation to world supplies.** *Bull. imp. Inst., Lond.* 46 (2/4), 1948 (158-79).

Includes East African Cedarwood oil from *Juniperus procera* (Kenya), Eucalyptus oils from *E. citriodora* and *E. staigeriana* (Seychelles and Nyasaland) and Nutmeg oil from *Myristica*

fragrans (Grenada), all of which are produced in relatively small amounts.

584. MATEI, I., and COCEA, E. Étude des huiles extraites des feuilles de conifères de Roumanie. [Study of oils extracted from needles of Rumanian conifers.] *Bulletin de l'École polytechnique de Jassy* 3 (1), 1948 (416-25). 5 refs. [F.f.] E.M.B.

Gives the results of an examination of oils from needles of Rumanian *Abies alba*, *Picea abies* and *Pinus sylvestris*. Tables show yields according to species and age, and the physical and chemical properties of the oils and of some of their fractions. Data are also presented on the fractions of oil of *A. alba* obtained by re-distillation at normal pressure and *in vacuo*. The bornyl ethers of this oil were identified and borneol was separated. *From authors' summary.*

585. BERRY, P. A. Recent investigations on the phellandrenes and their biogenetic relationships to the constituents of the essential oil of *Eucalyptus cneorifolia*. *Australasian Journal of Pharmacy* 28, Special Conference Issue, 1947 (862-8). 30 refs. L.S.

586. NARASINGA RAO, M., SUBBAIAH, R., and VENKATESWARULU, A. Characteristics and composition of vegetable fats in relation to the plant. *J. Coun. sci. Industr. Res.*, India 8 (3), 1949 (75-7). 100 refs. I.H.

A systematic examination was made of available data (from literature) on the characteristics and composition of seed oils, with special reference to the degree of saturation. The results of the examination, covering 19 families, 10 consisting of trees, 7 of shrubs and herbs and 2 of trees, shrubs and herbs, are tabulated. They show that the seed fats derived from trees are generally more saturated than those from herbs and shrubs. This does not hold for species containing unusual acids (e.g. certain of the Euphorbiaceae) or for trees originally belonging to temperate climates, e.g. Coniferae and Juglandaceae, which contain drying oils although they are all large trees.

587. La semilla del zapote, una gran fuente oleaginosa. [Sapote seed, an extensive source of oil.] *Rev. Agric., Costa Rica* 21 (2), 1949 (81). [Span.] A.P.B.

Describes briefly some uses of the seed of *Calocarpum mammosum*, at present unexploited in Costa Rica. Extraction of the ground

seed with gasoline produces a vaseline-like, light-coloured oil, which can be used in the manufacture of high-grade soap. From destructive distillation of the seeds can be obtained nitrobenzene and a charcoal of good quality suitable for printer's ink, shoe polish and similar products.

588. AGGARWAL, J. S., and SONI, P. Chemical examination of the oil from the seeds of *Gmelina asiatica* Linn. *J. sci. industr. Res.*, India 8b (3), 1949 (49-51). 8 refs. I.H.

589. Candlenut oil. *Industrial Chemist*, London 22 (262), 1946 (679). L.S.

An Australian investigation of Candlenut oil from *Aleurites moluccana* showed a clear similarity to Tung oil. It was also found that the rate of thickening on heating, rate of drying and the permeability by water of the dried film, were of the same order as linseed oil, and it is thought that Candlenut is a promising substitute for linseed oil. Cost of collecting the seed in Australia is about £6 (Australian) per ton, and costs of shelling and extracting oil from the kernels are estimated at about £1 per ton of kernels. On this basis Candlenut oil could be produced for between 4 and 5s. per gal. [cf. *For. Abstr.* 9 (No. 1822).]

590. MANTELL, C. L. The water-soluble gums—their botany, sources and utilization. *Econ. Bot.* 3 (1), 1949 (3-31).

An account of the most common water-soluble gums, with a list of commercial gums and their geographical and botanical sources.

591. BELLOUARD, P. La gomme arabique en A.O.F. [Gum arabic in French West Africa.] *Bois For. Trop.* No. 9, 1949 (3-18). 6 refs. [F.]

A short account is given of the distribution of *Acacia senegal* with a description of the stands in different parts of French West Africa. In general they consist largely of old trees, regeneration being destroyed by bush fires and browsing by nomadic herds. Experiments in direct sowing have been unsuccessful, chiefly owing to drought. Experiments in cutting down the trees which have ceased to yield gum, led to the conclusion that coppice regrowth occurs only in trees of 12-13 cm. in diameter or less. Larger trees do not coppice, and to fell them makes the situation still worse, by removing seedbearers. The method now

recommended is fire exclusion combined with exclusion of cattle for a period sufficient to get regeneration beyond the stage at which it is browsed. When herdsmen are allowed access to the stands, they should be encouraged to lop or cut down *Balanites aegyptiaca* and *Acacia raddiana*, which constitute 95% of the stands and are the most dangerous competitors of *A. senegal*. Cattle are an almost essential factor in natural regeneration as a vehicle of dissemination.

Some notes are given on methods of collecting the gum, yield, and market conditions.

592. COOMBER, H. E., and COOMES, T. J. **Gum arabic from Tanganyika.** *Bull. imp. Inst., Lond.* 46 (2/4), 1948 (231-4).

Report of an analysis of 3 samples of gum arabic collected from *Acacia* [species not indicated] in Tanganyika, where native *Acacia* are being examined for this product. The samples were satisfactory as regards ash, matter insoluble in cold water, colour and acidity, though they furnished solutions much less viscous than commercial Kordofan cleaned gum. The results are considered encouraging enough to warrant the continuation of the investigations.

593. **Tapping of *Sterculia urens* (Kullu).** *Rep. For. Res. C. P. & Berar* 1947, 1948 (9-14).

The lay-out of the experiment (in 1937) is described and the data derived over a period of 9 years are analysed. The following indications were obtained:—(1) The yield of gum is much higher in summer than in winter. (2) The yield from trees over 96 in. g.b.h. in winter and from trees over 84 in. g.b.h. in summer is higher than from trees of smaller girth. (3) Blazing gives higher yield than notching. (4) Direction of the blaze has no effect on yield. (5) The blazed area of oblong, rectangular, or square blazes, occludes at the rate of about 51.7 sq. in./year. (6) Blazing to the extent actually done during the experiment (up to 15 blazes per tree, with fortnightly freshening), seriously impairs the health of the trees. (7) The loss in weight of freshly collected moist gum by air drying is about 8.4%.

594. FYFE, A. J. **Gutta percha.** *Malay. Forester* 12 (1), 1949 (25-7).

Describes the methods of collecting and preparing gutta percha from *Palaquium gutta* in Malaya. Current departmental production amounts to only a few tons per year.

595. [MEREDITH, C. C.] **Vegetable Ivory Palm.** Notes on the collection of the sap of the Vegetable Ivory Palm (*Hyphaene ventricosa*) and manufacture of Palm wine spirit. *Rhod. agric. J.* 45 (5), 1948 (414-7). E.M.B.

34.27. Seeds. Fruits. Leaf Fodder. Fibres and Flosses

See also *For. Abstr.* 11 (Nos. 586-9).

596. SNOW, O. W. **Animal food stuffs [in the Sudan, with appendices listing suitable trees, shrubs, herbs and grasses].** Pp. 668-87 in Tothill, J. D., *Agriculture in the Sudan*, Oxford University Press, London, 1948. O.R.E.

Cf. *For. Abstr.* 11 (No. 32).

597. PETRUCCI, E. **Biometria e composizione chimica delle ghiande di alcune querce (*Quercus robur* L. δ *sessiliflora* (Salisb.), *Q. robur* L. α *pedunculata* (Ehrh.), *Q. cerris* L., *Q. ilex* L.) impiegate nell'alimentazione dei suini nella Campagna Romagna. [Size and chemical composition of the acorns of *Q. robur*, *Q. sessiliflora*, *Q. cerris* and *Q. ilex*, used for feeding pigs in the Roman Campagna.] *Repr. from Annali della Sperimentazione agraria, Rome (n.s.)* 1 (2), 1947 (343-58). [It.it.e.] ABD.R.**

Average weight and dimensions of the acorns of each species varied markedly from year to year but the species were always in the following (descending) order of size:—*Q. sessiliflora*, *Q. ilex*, *Q. robur*, *Q. cerris*. The pericarp and the kernel, considered separately, varied considerably from one species to another in chemical composition, but these differences were partly smoothed out, taking the acorns as a whole, since a pericarp poor in nutrients tends to accompany a kernel rich in them, and *vice versa*. The differences between species for the whole fruit are not enough to make a significant difference in the nutritive value of the acorns, except that those of *Q. sessiliflora* have a slightly higher protein content than those of the other species.

598. MAYMONE, B., and PETRUCCI, E. **Composizione chimica, digeribilità, metabolismo dell'azoto ed energia metabolizzabile delle foglie di *Ficus carica* L. impiegate nell'alimentazione animale. [Chemical composition, digestibility, nitrogen metabolism,**

and metabolic energy of the leaves of *Ficus carica* used as animal fodder.] *Repr. from Annali dell'Istituto sperimentale Zootechnico di Roma* 3, 1945 (297-328). [It.it.g.e.] ABD.R.

599. **An important fodder tree. Fruit crop as a succulent winterfeed.** *Fmg. S. Afr.* 24 (274), 1949 (4, 14, 29). E.M.B.

A useful source of fodder in South Africa is the Mexican Hawthorn (*Crataegus pubescens* and *C. mexicana*) which bears large crops of fruit in May-July when there is a scarcity of nourishing feed. Experimental plantings of *C. mexicana* have been made in the Transvaal by the Department of Agriculture, and results, so far, are encouraging. Some data on fruit quality and yield from *C. mexicana* are given. Mexican Hawthorn does not germinate easily, and some difficulty has been experienced in obtaining transplants. Up to date most success has been gained by extracting the seeds from the kernel and planting them in nursery trays or seedbeds. Care must be exercised in selecting seed, since *C. pubescens* hybridizes readily and the same heavy fruit crops are not obtained from the hybrids. It is important also to keep young stock free of weeds. If Mexican Hawthorn were planted in the Transvaal with *Acroceras* grass and other fodder trees (Oaks, *Gleditsia*) it is thought that winter trekking could be eliminated.

34.28. Bamboos. Canes

See also *For. Abstr.* 11 (Nos. 187, 489).

600. TOWERS, W. K. **Tropic furniture of rattan** [: manufacturing details]. *Wood-Worker, Indianap.* 58 (2), 1949 (28, 30-1). P.R.

35. SALE AND DISPOSAL OF FOREST PRODUCTS. TIMBER TRADE

See also *For. Abstr.* 11 (Nos. 25, 405, 458, 542, 789).

601. **1948 Yearbook of forest products statistics.** Food and Agriculture Organization of the United Nations, Washington, D.C. 1949. pp. 205. [E.F.Span.] 46 tbls.

Contains information for the years 1946 and 1947 for 95 countries.

602. MEIGGS, R. **Home timber production (1939-1945).** Crosby Lockwood & Son

Ltd., 39 Thurloe Street, London, S.W.7. 1949. pp. 277 + 24 photos. 8 refs. Price 15s.

A general survey with chapters covering:—organization; the raw material; production policy; trade production in England and Wales, and Scotland; state production; war-time uses of home timber; labour; plant, machinery and transport; statistical control; and prices and costs.

603. MACGREGOR, J. J. **Timber supplies and prices in recent years and future prospects.** *Quart. J. For.* 43 (1), 1949 (6-15).

An attempt to measure the effect of the war both on home and imported supplies and on the prices of timber, in the United Kingdom. The data are tabulated and compared for the years 1938-48 inclusive.

604. Valtion metsien pysty- ja hankintamyyneistä. [On sales of standing timber and sales by delivery contract from State forests [in Finland].] *Silva fenn.* No. 63, 1948. pp. 64. [Fie.]

The report of a committee appointed in 1946 to investigate the economics of these methods of sale.

605. Ulkomaankauppa. Vuosijulkaisu 67, 1947. [Foreign commerce. Annual report 67, 1947.] Suomen Virallinen Tilasto, Helsinki, Finland. 1948. pp. [4] + 202. [Fi.Sw.f.]

606. Eksportstatistikk 1948. [Statistics of exports [from Norway and Sweden] for 1948.] *Norsk Skogind.* 3 (2), 1949 (50-2). [Nor.] P.R.

607. ERIKSEN, C. F. Trelastindustrien i 1948. [The timber industry [in Norway] in 1948.] *Norsk Skogind.* 3 (1), 1949 (8-10). [Nor.E.] P.R.

608. LYLE, A. Tremasseindustrien i 1948. [The mechanical pulp industry in 1948.] *Norsk Skogind.* 3 (1), 1949 (7). [Nor.E.] P.R.

609. MICHELET, C. F. Celluloseindustrien i 1948. [The chemical pulp industry [in Norway] in 1948.] *Norsk Skogind.* 3 (1), 1949 (5-6). [Nor.E.] P.R.

610. ROLFSSEN, R. Papir-, papp- og kartongindustrien i 1948. [The paper, pulp and cardboard industry [in Norway] in 1948.] *Norsk Skogind.* 3 (1), 1949 (3-4). [Nor.E.] P.R.

611. ØDEGAARD, N. Wallboardindustrien i 1948. [The [Norwegian] wallboard industry in 1948.] *Norsk Skogind.* 3 (1), 1949 (11). [Nor.E.] P.R.

612. FRYER, E. R. El proyecto maderero de la Corporación Boliviana de Fomento. [The timber-industry plan of the Development Association of Bolivia.] *Bol. for. Univ. 'San Simon', Cochabamba* No. 1, 1948 (17-25). [Span.]

Gives some data on the Bolivian forests, collected by H. de Irmay, and includes tables showing the amount of sawtimber per ha. in 8 different areas, and some estimated costs of timber production. The article also contains the outlines of a plan drawn up by H. E. Holman for the establishment of an adequate timber industry in Bolivia. The greater part of Bolivia's timber is at present imported from the U.S.A. but it is considered that rational exploitation of the country's forests could produce timber well in excess of her domestic consumption.

613. BRUSH, W. D. **Selling Black Walnut timber.** *Fmrs.' Bull. U.S. Dep. Agric.* No. 1459 (rev.), 1948. pp. 19.

38. CONSTRUCTIONAL WORKS. ENGINEERING

See also *For. Abstr.* 11 (No. 338).

38.2. Building Construction. Foundations and Superstructures

See also *For. Abstr.* 11 (No. 340).

614. SCOFIELD, W. F., and O'BRIEN, W. H. **Modern timber engineering.** Southern Pine Association, New Orleans. 3rd ed., 1949. pp. 147. 38 refs. Price \$1.50.

Contains chapters on: the structure and characteristics of wood; strength properties, loads and stresses; fastenings; beams; columns; trusses; docks and bridge floor systems; glued laminated lumber; round timber piles; wood preservatives; and fire resistance of wood construction. There are numerous diagrams, graphs and tables, and examples illustrating methods of calculating loads, stresses and sections.

615. **The timber house construction of the Puutalo Oy.** *Papp. Trävarutidskr. Finl.* 31 (7a), 1949 (54-65). [E.] P.R.

Describes, with photographs, ground plans and diagrams of structural details, types of Finnish wooden houses manufactured for home use and for export.

616. GRAINGER, H. W. **The craft of the carpenter and joiner.** (3)-(8). *Ill. Carp. Build.* 138, 1949 (162-3; 226-7; 290-2; 356, 358, 360; 422, 424, 484, 486). P.R.

[Cf. *For. Abstr.* 10 (No. 2695).] The present instalments deal with:—(3) Construction of timber floors; (4) roofing work; (5) geometry and roof bevels; (6) roof trusses; (7) details of sashwork; and (8) double-hung sliding sashes.

617. **T.D.A. roof type A.** *Design Sheet Timb. Developm. Ass., Lond.* Nos. 1-4, [n.d.]. pp. 3 + 3 + 3 + 3. P.R.

Design sheets for roofs of different spans ranging from 17 ft. to 26 ft. for 2 main pitches, viz. 40° for plain tiling and 35° for interlocking tiles and slates.

618. Assemblages de charpente: les organes d'assemblages. [Timber connectors.] *Rev. Bois Appl.* 4 (4), 1949 (26). [F.]

619. REECE, P. O. **Tests on bulldog connectors.** *Construct. Res. Bull. Timb. Developm. Ass., Lond.* No. 3, [n.d.] pp. 12. 3 refs. P.R.

Tests on *Pinus sylvestris*, at about 18% moisture content, to determine maximum loads for 2- and 3-in. bulldog connectors with $\frac{1}{4}$ -, $\frac{1}{2}$ - and $\frac{3}{4}$ -in. bolts, subjected to compression perpendicular and parallel to the grain and tension parallel to the grain. Results are given in graphs and tables.

620. NICHOLS, W. **Plywood in building** 1. Possibilities and advantages. 2. Light weight and economy of materials. *Timb. & Plyw.* 95 (2472; 2473), 1948 (873-4, 876; 915-6). P.R.

38.3. Road and Bridge Construction

See *For. Abstr.* 11 (Nos. 58-9).

38.8. Torrent Training

See *For. Abstr.* 11 (No. 45).

4. FOREST INJURIES AND PROTECTION

621. HAWLEY, R. C., and STICKEL, P. W. **Forest protection.** John Wiley and Sons, Inc., New York; Chapman and Hall Ltd., London. 2nd ed., 1948. pp. x + 355. 436 refs. Price £1. 7s.

A textbook for students, with particular reference to North American conditions. Fire is treated more fully than other injurious agencies (170 pp.). The original edition appeared in 1937, and the bibliographies appended to separate chapters have been brought up to date.

41. TECHNIQUE OF FOREST PROTECTION

622. POTTS, S. F. **Mist-blower application of concentrated sprays.** *Proc. nat. Shade Tree Conf.* 1948, 1949 (134-8). 2 refs.

623. GUNN. **Application of insecticides and fungicides from the air.** *Report on the 4th Commonwealth Mycological Conference* 1948 (76-9).

Reviews the principal methods—the Porton, the cloud method, and curtain spraying.

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

See also *For. Abstr.* 11 (Nos. 146, 252, 675).

42.2. Temperature Influences

See also *For. Abstr.* 11 (No. 260).

624. **Severe winter injury to evergreens in Wisconsin.** *Plant Dis. Repr.* 32 (9), 1948 (394-5). [Division of Entomology, Wisconsin Department of Agriculture, Madison.] A.P.B.

A brief account of widespread winter damage in Wisconsin and the Lake States generally in 1947-8, which scarcely any evergreen species escaped. It is recognized that the death of the tissues results from a lack of water supply to needles, twigs and branches. This usually occurs during a relatively dry winter, with much sunshine and dry wind. Shallow-rooted trees are most susceptible to damage. Pruning of dead wood should be deferred until buds begin to open, when it can be easily distinguished. Application of fertilizers after prun-

ing will encourage the formation of new tissue, if adequate moisture is maintained.

42.3. Precipitations

625. [Reaction of *Gmelina arborea* to flooding and to fire.] *Rep. For. Adm. Nigeria* 1947-8, 1949 (22).

Gmelina arborea, an exotic species in Nigeria, has proved completely intolerant of flooding. Even well established trees, 12-15 ft. high, were killed by abnormally high water which reached them for the first time. Contrary to expectations, this species apparently suffered no damage from a serious ground fire, and in fact burst into leaf again before the fire-resistant Teak.

43. FOREST FIRES

43.0. Predisposing Factors and Causes

626. VILLENEUVE, G. O. Méthodes d'évaluation de dangers d'incendie forestier au Canada et aux États-Unis. [Methods of rating forest-fire danger in Canada and the United States.] *Bull. Bur. Mét. Québec* No. 13, 1949. pp. 57. 54 refs. [F.] Cf. *For. Abstr.* 10 (No. 2218).

627. CROSBY, J. S. **Forest fire burning conditions in the Lake States.** *Sta. Pap. Lake St. For. Exp. Sta.* No. 16, 1949. pp. 17.

Analysis of forest fire records of the national forests of the Lake States for the period 1936-47 shows that the number of fires per day and the size of an average fire are both approximately doubled for each increase of burning conditions to a more severe class. No fire of 100 acres or more occurred when the burning index was 'safe' or 'very low'. One large fire out of 67 occurred on a 'low' day, whereas all the others occurred on 'moderate' or more severe days. *From author's summary.*

628. LINDENMUTH, A. W. JR., and KEETCH, J. J. **Open method for measuring fire danger in hardwood forests.** *Tech. Note Stheast. For. Exp. Sta.* No. 71, 1949. pp. 11.

Deals with modifications and technique necessary for measuring forest-fire danger at

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stations in the open, which are often more convenient than in the forest.

629. **POTVIN, A. A simple method of dew measurement.** *For. Chron.* 25 (1), 1949 (52-3).

The Dominion Forest Service has devised a simple means of dew measurement, involving the use of a sheet of glass on which dew collects and from which it drips into a graduated gauge. The amount collected is read directly from the gauge. The total cost of the instrument is about \$1.50. A further analysis will be undertaken to study the effect of forest canopy on dew, the effect of dew on different fuels, and its value as a retardant in forest-fire control.

630. **MACLEOD, J. C. Effect of topography on hygrometer readings.** *For. Chron.* 25 (1), 1949 (32-3).

In a previous article [cf. *For. Abstr.* 9 (No. 1258)] the author discussed the effect of site upon the measurement of relative humidity with Mason-type hygrometers. Further investigation indicates that, except in mountain areas, topography does not greatly affect the measurement of relative humidity so far as the requirements of forest fire protection are concerned. The chief effect of topography is in obstructing the free movement of air in the immediate vicinity of the hygrometer.

631. **SCHAEFER, V. J. The possibilities of modifying lightning storms in the Northern Rockies.** *Sta. Pap. Nth. Rocky Mt. For. Range Exp. Sta.* No. 19, 1949. pp. 17. 5 refs.

Gives an account of studies of the formation of thunder clouds in the Northern Rocky Mountains and discusses the possibility of using 'dry ice' to dissipate such clouds before they generate lightning. In the national forests of Region One, lightning-caused fires were as many as 1,488 in one 10-day period. An outline of a desirable programme of observations is given.

632. **DAVIS, W. S. The rate of spread/fuel density relationship.** *Fire Control Notes* 10 (2), 1949 (8-9).

Controlled burning was carried out in the Nebraska National Forest, in order to determine whether fire would spread through sparse grass at the same speed as through dense grass. All tests showed conclusively that the reduction of fuel density has a marked effect on both the

rate of spread and the intensity of grass fires. Under the test conditions, the residual density of grass represented by an incidence of 0.3 animal months per acre allowed fires to advance 3 times as fast and with 5 times the intensity of fires in areas that had been grazed twice as heavily.

43.1. Protective Measures (including Controlled Burning)

See also *For. Abstr.* 11

(Nos. 147-9, 223, 226-7, 766, 805).

633. **FRASER, F. A. Fire protection problems [: a summary].** *B.C. Lumberm.* 33 (3), 1949 (65-6, 109-10, 112, 114, 116).

634. **Forest fire control plan for the Petawawa Forest Experiment Station, Chalk River, Ontario.** Dominion Forest Service, Ottawa. 1948. pp. 36 + map.

635. **HARRISON-SMITH, J. L. Protective burning.** *N.Z. J. For.* 5 (5), 1948 (1949), (428-30).

Describes a combination of prescribed burning and ploughed fire lines which is cheaply carried out in the highly inflammable scrub surrounding plantations near Mt. Edgecumbe. The system developed from the observations of a bulldozer driver, who noticed that quite a narrow fire line would stop a scrub fire meeting it obliquely. He reasoned that, if fire-breaks could be so arranged that any approaching fire would be forced to meet one break obliquely, an effective fire-break system could be built up with much less expenditure of labour and machinery than that necessary for the conventional single ploughed strip parallel with the edge of the trees.

636. **NORDSTRÖM, L. Hjälpmedel för tändningens utförande under hyggesbränning. [Aids to firing in the controlled burning of felled areas.]** *Skogen* 35 (23), 1948 (275-6). 1 ref. [Sw.]

The apparatus described by Runquist [see *For. Abstr.* 10 (No. 1396)] had the disadvantages of heavy fuel consumption and of producing a large flame which occasionally inconvenienced the operator. In collaboration with the Primus Co. the author has devised an improved model which can be used either as a blow-lamp alone, where the cover is readily ignited, or, for more difficult cover, to direct a

separate jet of kerosene into the bottom layers of the cover, which is then fired with the blow-lamp. The outfit consists of a back-packing kerosene container, with pump and manometer gauge, from which the fuel is led through a flexible reinforced rubber pipe to (a) the blow-lamp, which works continuously; and (b) the jet nozzle, which can be turned on when required and which forces a jet of kerosene into the ground cover. The jet converges with the blow-lamp flame about 20 cm. from the lamp, but is not ignited until it has penetrated the ground cover. With continuous use of jet and lamp together, 10 litres of kerosene last *ca.* 1 hour using a jet nozzle of 0.6, or *ca.* 1½ hrs. with one of 0.4 mm. diameter. The blow-lamp alone will run for 20 hrs. on the same quantity of fuel. The tank can be filled with the blow-lamp in operation, and there is no need to turn off the lamp at meal times or other breaks in the work. The fire set with this apparatus is slow and effective. By holding the blow-lamp some 20 cm. from the ground vegetation, quick ignition can be obtained, but, if desired, the jet will carry about 4 m. and an object can be soaked with kerosene from that distance and left to be ignited as convenient. The apparatus is shown in photographs.

637. NORDSTRÖM, L. Olycksfallsrisken under hyggesbränning vid användande av fotogen för tändningen. [Accident risks involved in the use of kerosene for firing in the controlled burning of felling areas.] *Skogen* 35 (24), 1948 (291). [Sw.]

To minimize accidents with the author's kerosene 'torch' [see preceding abstract] the fuel tank should be of iron, tested for a pressure of 8 kg./sq. cm. (double the pressure at which the blow-lamp works well), the inside galvanized against corrosion. No other liquid should be used in them. A special outlet valve must be fitted, so that the flow of fuel stops if a break should occur in the flexible tubing. The latter should be of oil-resistant rubber, doubly reinforced with fabric and protected externally with a spiral wire reinforcement. The apparatus must be thoroughly overhauled each year before the burning season and should be tested daily for leaks by applying about double the normal working pressure. In actual operation the joints should be looked at now and then, and spare packing for these always carried.

638. FRY, J. F., and SMART, P. M. T. Use of wetting agents against heath and undergrowth fires. *Nature, Lond.* 163 (4152), 1949 (844-5). [Department of Scientific and Industrial Research, and Fire Offices Committee, Joint Fire Research Organization, Elstree.]

Investigations were made of the action of wetting agents in (1) extinguishing fires, (2) preventing their spread, and (3) wetting dry materials at normal temperatures (i.e. without fire). The combustible materials used were ling (*Calluna vulgaris*), bracken (*Pteridium aquilinum*), and purple moor grass (*Molinia caerulea*) in a very dry state. In each series the effectiveness of water was tested against that of 0.2% aqueous solutions of each of 3 commercial wetting agents (one non-ionic and two anionic). In (1) no significant difference was observed between water and any wetting agent solution either in the time taken to extinguish the fire or in the amount of liquid used. In (2) the quantity of liquid required to prevent the advance of flame from dry to wet zone was halved by using wetting-agent solutions. In (3) little difference was noted between the behaviour of wetting-agent solutions and water. It was concluded that wetting agents may be of value in controlling heath fires by the technique of wetting the unburnt materials ahead of the fire.

43.3. Fire Damage

See also *For. Abstr.* 11 (Nos. 275, 625).

639. NUTTING, A. D., RETTIE, J. C., and BANKS, W. G. Rehabilitation of fire-damaged forest lands in southwestern Maine. *Sta. Pap. Ntheast. For. Exp. Sta. No.* 23, 1949. pp. 21.

Estimate acreage burned, and area requiring artificial regeneration.

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

See also *For. Abstr.* 11 (Nos. 622-3).

44.1. Forest Weeds

See also *For. Abstr.* 11 (Nos. 284-5).

640. DAVIES, J. G. Biological control of insects and weeds. *Report on the 4th Commonwealth Mycological Conference* 1948 (79-81).

A statement about plant pathogens as potential agents in weed control.

641. [Control of *Gleichenia*]. Rep. Dep. Agric. Seychelles 1946, 1948 (7).

Bracken (*Gleichenia* spp.) was kept under control by hand cutting on plantations. An experiment was carried out to test the effectiveness of applications of guano and H_2SO_4 on the control of bracken, but it became apparent that hand cutting was the cheapest and most efficient method of control.

642. DOMEIJ, Å. Några skogs- och lundväxters känslighet för natriumklorat. [The sensitivity of some wood and meadow plants to sodium chlorate.] Medd. SkogsforsknInst., Stockh. 37 (6), 1948. pp. 16. 8 refs. [Sw.sw.e.]

Observations over a period of 3 years on the effect of different concentrations of sodium chlorate on vegetation in an Oak and mixed coniferous wood show that plants vary in their sensitivity. *Calluna vulgaris* and *Hypericum quadrangulum* are killed at concentrations of 2.5–5 g./sq. m., *Vaccinium myrtillus* at 5, *Pteridium aquilinum* at 10, and *Trifolium medium*, *Veronica chamaedrys*, *Melampyrum pratense*, *Linnaea borealis*, *Vaccinium vitis-idaea* and *Polytrichum commune* at 10–20 g./sq. m. Young *Picea abies* shed their leaves at 10 g./sq. m. and died at higher concentrations. *Cirsium arvense*, *Urtica dioica* and *Agropyron repens* are fairly sensitive. *Anemone nemorosa*, *Lathyrus sylvestris*, *Convallaria majalis*, *Orchis maculata*, *Habenaria bifolia*, *Anthoxanthum odoratum*, *Majanthemum bifolium*, *Oxalis acetosella*, *Hylacomium parietinum* and *H. proliferum* survive at concentrations from 20 to 40 g./sq. m. *Potentilla erecta*, *Trientalis europaea*, *Luzula pilosa* and *Orobis tuberosus* are resistant at concentrations of 40 g./sq. m. Trees and bushes, except young *Picea abies*, are largely resistant at concentrations of 50 g./sq. m. (the limit of the experiment). *Pinus sylvestris* and *Juniperus communis* appear to be insensitive to the salt; *Quercus robur*, *Betula verrucosa*, *Sorbus aucuparia*, *S. suecica* and *Populus tremula* are uninjured and their growth appears to be promoted, probably owing to decreased root competition. From author's summary.

643. Chemical eradication [of *Ribes* for blister-rust control]. Rep. N.Y. St. Conserv. Dep. 1947, 1948 (70).

The difficulty of confining the lethal effect to Currant and Gooseberry bushes, when chemicals are applied as spray, has hitherto limited their use. A dry mixture of salt and borax has proved effective when applied in small quantities to the crowns of decapitated *Ribes* bushes that were too large to be easily uprooted. It is hoped that the regeneration of *Ribes*, which frequently occurs as a result of soil disturbance in the uprooting of large bushes, may be greatly reduced by the use of chemicals.

644. EGLER, F. E. Herbicide effects in Connecticut vegetation, 1948. Ecology 30 (2), 1949 (248–56).

This is the third report on a project being carried out at Aton Forest, Conn. [For earlier reports see *For. Abstr.* 9 (No. 1265); 10 (No. 2233).] During 1948 experiments were made on 116 species of herbs, shrubs and trees, using several combinations and concentrations of 2,4-D and 2,4,5-T, applied both by spraying and by various methods of wounding and painting. A mixture of both esters in an 0.5% solution was the most satisfactory of the solutions used. Spraying in the shade seemed at least as effective as spraying in full light. Effects on *Acer* and *Fraxinus* seemed more pronounced in the shade than in the light. Painting of new-cut stumps of *Alnus*, *Betula*, *Salix*, *Prunus pennsylvanica* and *Vaccinium*, appeared to be effective throughout spring and early summer.

Trunk-wound painting was effective on *Alnus*, *Betula*, *Salix*, *Rhus*, young *Populus tremuloides*, and *Prunus pennsylvanica*. For this purpose, the bark was removed from an area 6 in. square near the base of the trunks, and the wound painted with herbicide. This appears to be the cheapest and most efficient way of killing certain shrubs and trees up to 30 ft. high. Experiments in trunk-wound painting showed the herbicidal effects to be remarkably confined to vertical translocation. Discoloured bark and dead branches could be traced above the wound, spiralling sometimes, presumably when the grain was spiral.

Bark painting, which is even cheaper, produced an effect in White Pine, though complete kill has not yet been verified.

In all cases of herbicide application, resistant species showed a marked variation in resistance between individuals of the same size, even when growing in close proximity.

645. BARRONS, K. C., and COULTER, L. L. **Year-around stump treatment for woody plant control.** *Down to Earth, Midland, Mich.* 4 (2), 1948 (4). 2 refs. [The Dow Chemical Co.] I.M.I.

Stump treatment with Esteron 44 in fuel oil, soon after felling, reduces coppicing by 75%. On species susceptible to 2,4-D a solution of 1% Esteron 44 in fuel oil or kerosene gave excellent results. As a foliage spray 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) is very effective on certain species that are resistant to 2,4-D, particularly on Osage Orange [*Maclura* sp.] and various *Rubus* species. An isopropyl ester formulation of 2,4,5-T, called Esteron 245, is now available, and is used along with Esteron 44 for foliage spraying in brush-control operations throughout the Appalachian region, where wild Blackberry is a serious problem. For stump treatment, where 2,4-D-resistant species are known to occur, a mixture of 1% Esteron 44, 1% Esteron 245 and 98% oil is suggested. A single but thorough wetting of the cut surface and the bark, down to the ground, from a knapsack sprayer, is recommended.

646. GILGUT, C. J. **Control of weeds in the nursery by chemical sprays.** *Bull. Mass. agric. Exp. Sta.* No. 436, 1946 (54).

Notes on the use of 'Savacol No. 5', an oil spray generally used in horticultural practice. Coniferous species, except *Taxus*, are mostly tolerant of Savacol No. 5, but broadleaved species suffered considerable damage.

647. **Use of selective weed killers.** *Rep. For. Timb. Bur. Aust.* 1947, 1948 (14).

It has been shown that the use of pre-emergence sprays of Methoxone may greatly reduce the number of weeds which germinate in *Pinus radiata* seedbeds, without harmfully affecting the germination of the Pine or the subsequent development of the seedlings.

648. CLIFFORD, E. D. **Weed control in Guayule seedbeds with stove oil.** *J. For.* 47 (4), 1949 (271-6). 6 refs.

A detailed account of experiments made during the war, describing pressure nozzles, mixture of oil and water, time of day and stage of weed development for spraying. It is suggested that the results (reduction of cost of weeding to as little as 10% of that of hand weeding) might be of interest in forest nurseries.

44.3. Fungi

See also *For. Abstr.* 11
(Nos. 150, 262-3, 643, 721).

649. **Forest pathology.** *Report on the 4th Commonwealth Mycological Conference* 1949 (81-3).

Report of a discussion on general questions of diagnosis and control.

650. McDONOUGH, E. S. **The relation of fungi to cavity formation in trees.** *Proc. nat. Shade Tree Conf.* 1948, 1949 (5-8). 9 refs.

A short review of the literature.

651. YOUNG, H. C. **Recent developments in fungicides and their evaluation, nature, compatibility, and use.** *Proc. nat. Shade Tree Conf.* 1948, 1949 (47-58). 4 refs.

652. ZENTMYER, G. A. **Recent trends in the field of fungicides.** *Trees, Cleveland (Ohio).* 9 (3), 1949 (21-2, 26, 30). 2 refs.

653. RISHBETH, J. ***Fomes annosus* Fr. on Pines in East Anglia.** *Forestry* 22 (2), 1949 (174-83 + 6 photos).

Research into the spread of *Fomes annosus* in Pine plantations in Suffolk showed that it can infect the stumps of recently felled trees by means of air-borne spores. It was also found that *Fomes* spores can infect stumps for only a limited period (about a month) after felling, owing to increasing competition from other fungi, which may exclude it altogether after a few months. The proportion of stumps infected varies with the season of felling; in 1946 infection was lowest in the summer. Healthy Pines are often infected when their roots touch others already containing *Fomes*, but the first trees to be killed in a stand are always infected from stumps. It is therefore important, on sites where the disease is likely to be severe, to try to exclude the fungus from stumps in the first place. An experiment in the same area showed that creosoting or painting the stump surface immediately after felling gave considerable protection from infection, whereas covering with soil gave none.

Experiment has shown that *F. annosus* does not live freely in the soil but is confined to woody tissues, probably because it is unable to compete with certain other fungi. It takes several years to occupy the whole root-system

of a stump and is often still present 15 years after felling.

The severity of attack in Pine plantations varies greatly with the site. On alkaline former arable or grassland the attacks are often severe, but on acid former heath or woodland they tend to be mild. Investigation showed that, in soils of the latter type, fewer living roots are infected round stumps containing *Fomes*, and *Fomes* is more rapidly replaced by other fungi in stumps. The soil fungi living in these contrasted soil types are themselves markedly different, which probably accounts for these facts. Thus, a number of the fungi in acid soils, such as *Trichoderma viride*, are antagonistic to *Fomes*, but there are few such competitors in the alkaline soils.

654. BJÖRKMAN, E. **Soil antibiotics acting against the root-rot fungus (*Polyporus annosus* Fr.)**. *Physiol. Plant., Copenhagen* 2 (1), 1949 (1-10). 15 refs. [E.e.] [Botanical Laboratory, College of Forestry, Stockholm.]

Samples of forest soil were collected in Sweden, Denmark and England, about half of them from the neighbourhood of trees infected with *Polyporus annosus*. A number of micro-organisms (chiefly *Penicillium* species) were isolated from these samples, and then tested for antibiotic effect on the growth of *P. annosus*. Some showed positive results on the mycelium, and there was some evidence that such antibiotic species were more abundant in soil samples free of *P. annosus*. Most, however, of the isolated soil fungi and bacteria that were proved to be poisonous to the root-rot fungus, seemed to be unable to produce substances of permanent antibiotic stability.

655. ENEBO, L. **Experiments with claviformin [from *Penicillium claviforme*] as an antibiotic against *Polyporus annosus* Fr.** *Physiol. Plant., Copenhagen* 2 (1), 1949 (56-60). 2 refs. [E.e.]

656. DAMON, S. C., and SNELL, W. H. **Two unusual hosts.** *Plant Dis. Repr.* 32 (10), 1948 (447). A.P.B.

Fusarium sp. caused damping-off of *Meta-sequoia glyptostroboides* seedlings; *Botrytis cinerea* was identified as the cause of infection in a branch of *Exochorda* (probably *racemosa*).

657. BUCHANAN, T. S. ***Poria weirii*: its occurrence and behaviour on species**

other than Cedars. *Repr. from Northwest Science* 22 (1), 1948 (7-12). 13 refs.

Recent investigations have shown that *Poria weirii*, hitherto regarded as specific to *Thuja* spp., occurs on and is destructive to all age classes of Douglas Fir from British Columbia to Oregon. Losses may be caused by its killing effects as a root rot, by added susceptibility to windthrow, or by decay of heartwood. The fungus also causes loss to *Tsuga heterophylla*, and has been found on *Abies amabilis*, *A. lasiocarpa*, *A. grandis*, *Picea sitchensis*, and *Pinus ponderosa*. [Cf. *For. Abstr.* 9 (No. 544).]

658. POMERLEAU, R. **Relation entre le développement des caries du sapin et le site. [Relation between the development of Fir rots and the site.]** *Annales de l'ACFAS, Montréal* 12, 1946 (79-80). [F.] L.B.M.N.

Previous studies have shown that the development of rot in Fir is in direct relationship to the age of the tree, and that the volume % of rot is greater on a rich than on a poor site. Comparison of results of recent observations with others from New England and the Lake States shows that for a given age class the volume % of rot and the number of rotted trees is considerably smaller in the northern coniferous than in the deciduous forests. The rate of decay and the % of brown butt rot increase with the distance from the northern zone.

659. TERRIER, C. A. **Un nouveau champignon parasite des aiguilles du sapin blanc: *Dimeriella terrieri*** Patrak nov. spec. in litt. [A new fungus, parasitic on Silver Fir needles: *Dimeriella terrieri*.] *Repr. from Bulletin de la Société botanique suisse, Berne* 57, 1947 (165-73). 10 refs. [F.] I.M.I.

660. GROVES, J. W., and LEACH, A. M. **The species of *Tympanis* occurring on *Pinus*.** *Mycologia* 41 (1), 1949 (59-76). 13 refs. P.R.

661. CAMPBELL, W. A. ***Phytophthora cinnamomi* associated with the roots of littleleaf diseased Shortleaf Pine.** *Plant Dis. Repr.* 32 (11), 1948 (472). 3 refs. A.P.B.

In March 1948, after an exceptionally wet winter, *Phytophthora cinnamomi* was isolated from the roots of a Shortleaf Pine (*Pinus echinata*) suffering from littleleaf disease [cf. *For. Abstr.* 10 (Nos. 1466, 2991)] near Athens, Georgia. In August 1948 other isolates of the

same fungus were obtained from diseased trees in Georgia and S. Carolina.

662. CAMPBELL, W. A. A method of isolating *Phytophthora cinnamomi* directly from soil. *Plant Dis. Repr.* 33 (3), 1949 (134-5). 2 refs. A.P.B.

Describes a simple method of isolating *Phytophthora cinnamomi* from the root area of healthy or diseased Shortleaf Pine (*Pinus echinata*) [cf. previous abstract]. Soil is tightly packed into a $\frac{1}{2}$ -in. hole bored diagonally into, but not quite through, an apple. The hole is filled with soil to within $\frac{1}{4}$ or $\frac{3}{8}$ in. of the top, the remaining space is filled with distilled water, and the opening is sealed up. The apples are kept at room temperatures ranging from 60 to 80° F. If *P. cinnamomi* is present, it causes a firm, dry rot of the apple tissue in 5-10 days. This rot can be distinguished from that caused by other kinds of fungus by the fact that it brings about no appreciable softening of the apple tissue. The presence of *P. cinnamomi* can be verified by examining the mycelium which develops on corn-meal agar round pieces of the rotted apple.

663. BALL, J. C. Association of White Pine with other forest tree species and *Ribes* in the Southern Appalachians. *J. For.* 47 (4), 1949 (285-91). 5 refs.

A study of the association of White Pine [*Pinus strobus*] with other forest species and *Ribes* in the mixed-hardwood forests of the Southern Appalachians was begun in 1944. Data obtained so far show that White Pine is gradually establishing itself on a wide variety of sites. Its optimum range of elevation is 1,200-3,500 ft. Fire- and blister-rust control during the last 14 years have materially aided the establishment of White Pine.

664. HEBB, E. A. A study of the influence of overstorey on the incidence of *Cronartium* cankers on Loblolly Pine. *Abstr. of thesis*, in *J. For.* 47 (5), 1949 (415).

Comparison of 38 pairs of plots (one with overstorey and one without) showed no significant difference in incidence of *Cronartium* canker.

665. WIDDER, F. Untersuchungen über forstschädliche *Cronartium*-Arten. (2. Mitteilung). [Studies on species of *Cronartium* injurious to forest trees. II.] *Repr. from*

'*Carinthia II*', *Mitteilungen des Naturwissenschaftlichen Vereines für Kärnten, Klagenfurt* No. 137/138, 1948 (82-93). 15 refs. [G.g.] [Institut für systematische Botanik, Graz.]

Records and illustrates with a sketchmap the known localities for *Cronartium gentianeum*, which causes a bark blister-rust of *Pinus sylvestris*. Ten years ago only 4 localities were known and the fungus seemed of no practical importance. Several hundred localities have since been discovered, distributed over the eastern parts of the natural range of *Gentiana asclepiadea*, the alternate host, and especially along the eastern fringe of the Alps.

666. WALLACE, G. B. Defoliation of crops by a gemmiferous fungus. *E. Afr. agric. J.* 14 (3), 1949 (141-3 + 6 photos). 8 refs. [Department of Agriculture, Tanganyika Territory.]

Describes an unidentified fungus attacking tea, coffee, *Eucalyptus* and a wide range of less important species in Tanganyika. Outbreaks observed in the Southern Highland Province in 1934 and in the Tanga Province in 1948 both followed misty and cold weather, and it is thought that outbreaks are liable to occur throughout East Africa at high elevations and near rain forest. The fungus is sterile and reproduces vegetatively by means of small club-shaped bundles of hyphae (called gemmae), which are borne on leaf spots and on coffee cherries. Forest with dense undergrowth or permanently damp thickets appear to be the sources of infection. Besides tea and coffee, 4 species of *Eucalyptus*, Camphor (*Cinnamomum camphora*) and *Syncarpia laurifolia* in forest plantations have been attacked. Opening up and ventilating forest or thicket will destroy the source of infection, and shelterbelts and shade trees should not be kept too dense. In susceptible areas spraying, e.g. with Bordeaux mixture, before the rains begin, may be necessary.

667. SKOLKO, A. J. Pathological studies [on die-back of Yellow Birch]. *Rep. N.S. Dep. Lds. For.* 1948, 1949 (63-5).

The fungus most commonly found on Yellow Birch showing symptoms of die-back, is a species of *Phomopsis*. A number of twigs were experimentally inoculated with this fungus. When a spore suspension was used, there was no evidence of successful inoculation. With a mycelial inoculum, there was some evidence of

successful inoculation, but the infected area did not extend very far.

668. GRASSO, V. Gli scopazzi sul *Carpinus betulus* da *Taphrina carpini*. [Witches' brooms on *Carpinus betulus*, caused by *Taphrina carpini*.] *Ital. for. mont.* 4 (2), 1949 (100-2). 6 refs. [It.]

669. GRAVATT, G. F. The Chestnut blight in Asia and North America. *Unasylva* 3 (1), 1949 (2-7).

670. PAVARI, A. Chestnut blight in Europe. *Unasylva* 3 (1), 1949 (8-13).

671. TREGGI, G. Il 'cancro della corteccia del castagno' nell'Appennino pistoiese. [Bark canker [*Endothia parasitica*] of Chestnut in the Pistoian apennines.] *Annali della Facoltà di Agraria, Università di Pisa (n.s.)*. 8, 1947 (254-7). C.G.B.

Notes on the diffusion of *Endothia parasitica* in the Pistoian Apennines.

672. BIRAGHI, A., and PAVARI, A. Sulla lotta contro le malattie del castagno. [The control of diseases of Chestnut.] *Ital. for. mont.* 4 (2), 1949 (64-77). [It.]

A résumé of the status of *Endothia parasitica* and *Phytophthora cambivora* in Italy, methods being used to combat them, and possible lines of research.

673. PIMENTEL, A. A. L. Novas observações sobre a morfologia, biologia e fisiologia de dois fungos do género *Phytophthora* de Bary, parasitas do castanheiro. [Further notes on the morphology, biology and physiology of two fungi of the genus *Phytophthora*, parasites of Chestnut.] *Agron. lusit.* 7 (4), 1945 (337-54 + 1 plate, 1 tbl.). 12 refs. [Port.port.e.]

674. BIRAGHI, A. Il disseccamento fogliare del castagno causato da '*Sphaerella maculiformis*'. [Premature leaf-fall of Chestnut, caused by *Sphaerella maculiformis*.] *Ital. for. mont.* 4 (1), 1949 (21-4). 6 refs. [It.]

Premature defoliation of *Castanea sativa* was very general in Italy in the summer of 1948. Examination of leaves from various regions revealed the presence of a parasitic fungus, *Sphaerella maculiformis* (Pers.) Auersw. This and other fungi are normally present on Chestnut leaves and the authors consider that

the unusually heavy infection last year was due to the abnormally wet and cold season. Low summer temperatures are particularly conducive to the spread of fungus infection. It was noted that trees of *C. crenata* raised from Japanese seed remained fresh and green when neighbouring *C. sativa* were almost leafless, and in hybrid populations those individuals most closely approximating to *C. crenata* were also apparently immune to *S. maculiformis*.

675. SZÁNTÓ, I. A bükkfa rákja mint éghajlati betegség. [Canker of Beech as a climatic disease.] *Erdész. Kisérl.* 48 (1/2), 1948 (10-31). 9 refs. [Hu.E.]

Discusses the primary causes of a disease of Beech [*Fagus sylvatica*] in Zala county, due to attack by *Nectria* sp. The primary causes of infection are bark breaks. Beech, which is not adapted to a continental climate, grows here at the limit of its distribution, and it is thought that bark cracks at the time of this infection (1920-21) were caused by an extraordinarily warm and dry winter and spring, which was followed by a cool and rainy June and July.

676. DIETZ, S. M., and YOUNG, R. A. Oak wilt [*Chalara quercina*]-a serious disease in Iowa. *Ext. Bull. Ia. State Coll.* No. P91, 1948. pp. 20. 6 refs.

Symptoms, host range, and recommendations for control.

677. WILSON, E. E. The pycnidial stage of the Walnut branch wilt fungus, *Exosporina fawcetti*. *Phytopathology* 39 (5), 1949 (340-6). 7 refs.

Exosporina fawcetti is judged to be the conidial stage of *Hendersonula toruloidea*, first isolated in 1933 from apples, peaches and apricots suffering from a die-back in Egypt. [Cf. *For. Abstr.* 10 (No. 2248).]

678. NATTRAS, R. M. A *Botrytis* disease of *Eucalyptus* in Kenya. *Emp. For. Rev.* 28 (1), 1949 (60-1 + 5 photos). 3 refs.

A disease attacking young trees of *Eucalyptus globulus* in Kenya is described. The disease, caused by *Botrytis cinerea* Pers., has been observed once only, during the exceptionally wet year of 1946. The fungus attacks juvenile foliage only. It causes desiccation of the leaves, and stem and branch cankers. *Author's summary.*

679. PIRONE, P. P. A new threat to London Plane trees. *Proc. nat. Shade Tree Conf.* 1948, 1949 (97-101).

Account of a new disease of *Platanus acerifolia* in New York, caused by a species of *Dothiorella*.

680. DIMOND, A. E., and POTTS, S. F. Control of Sycamore anthracnose [*Gnomonia veneta*] [on *Platanus acerifolia*] with mist blown fungicidal spray concentrates. *Proc. nat. Shade Tree Conf.* 1948, 1949 (130-4). 4 refs.

Control was effected, in decreasing order of effectiveness, by puritized agricultural spray, yellow cuprous oxide, and Fermate. Copper naphthenate was wholly ineffective.

681. LANSADE, M. Recherches sur le chancre du peuplier en France. [Research on Poplar canker in France.] *Annales des Épiphyties*, Paris 12 (1), 1946 (23-39). 28 refs. [F.] I.I.E.

Three types of Poplar canker have been observed in France:—(1) bark lesions, (2) typical canker and (3) tumours. Isolates were taken (a) from the damaged bark or from the excrescence which borders the canker, and (b) from the wood at varying depths. Studies were made of the organisms obtained and experimental inoculations undertaken. Bark lesions on *Populus alba* var. *bolleana*, *P. nigra* and *P. laurifolia* at Cuts (Oise) were associated with *Diaporthe* sp., which proved in experimental inoculations to be capable of penetrating the bark, and is therefore capable of a certain degree of parasitism. Bark lesions on *P. koreana* and *P. simonii* (also at Cuts) were associated with *Bacterium syringae*. This species belongs to a group of phytopathogenic bacteria sometimes called the 'fluorescent green group' and usually attacks non-lignified plants, or portions of plants. In these experiments isolates were made from lesions on one-year-old twigs of two frost-sensitive species during a cold, wet spring; and it is supposed that the twigs were insufficiently lignified to resist attack, which was encouraged by the action of frost and the low temperature. Canker proper was associated on *P. laurifolia* and *P. nigra* (also at Cuts) with *Diaporthe* sp. and on *P. nigra* with *Nectria* sp. Some of the *Nectria* isolates proved capable of initiating the first stages of the formation of cankers. Experiments with tumours on *P. nigra* gave no results.

682. POMERLEAU, R. Rapport général des travaux effectués sur la maladie hollandaise de l'orme dans la Province de Québec en 1947. [General report on measures taken against the Dutch Elm disease in the province of Quebec in 1947.] Service forestier, Ministère des Terres et Forêts, Québec. [1948.] pp. 33 + 2 gphs, 8 maps. [F.f.e.]

683. WENT, J. C. Verslag van de onderzoekingen over de iepenziekte en andere boomziekten, uitgevoerd op het phytopathologisch laboratorium 'Willie Commelin Scholten' te Baarn, gedurende 1947. [Report on investigations of Elm disease and other tree diseases, carried out in 1947 at the 'Willie Commelin Scholten' Phytopathological Laboratory, Baarn.] *Meded. Inst. toegep. biol. Onderz. Nat.* No. 6, 1948 (18-32). [D.u.e.] (*Mededeling No. 43 van het Comité ter Bestudering en Bestrijding van Ziekten in Iepen en andere Boomsoorten.*)

(1) *Ulmus*: Seedlings raised in 1940-5 were further tested for susceptibility to *Ceratostomella ulmi*. A previously reported correlation of leaf shape and size with susceptibility [see *For. Abstr.* 8 (No. 2109)] was not detectable. The greatest number of resistant seedlings was obtained from crosses in which selected numbers of *U. foliacea* or *U. glabra* No. 49 were the parents. Most of these were intraspecific crosses, but in two cases the second parents were respectively *U. pumila pinnato-ramosa* and *U. hollandica vegeta*.

Grafts of *U. foliacea* No. 62, No. 132 *U. hollandica* 5, and No. 139 *U. hollandica vegeta* × *U. foliacea* No. 1, so far show percentages of diseased plants of 13.7, 6.2 and 4.7, respectively. *U. foliacea* No. 62 is to be distributed to nurserymen. The growth of the above numbers is satisfactory and they showed no die-back after inoculation with *Nectria cinnabarina*.

An experiment was made on the injection of Elms with paranitrophenol [cf. *For. Abstr.* 9 (No. 1893)] immediately before inoculation with *C. ulmi*. The beneficial effect, if any, was slight, and since the bark round the site of injection was killed by this chemical, it is considered unsuitable as a chemotherapeutic agent.

(2) *Picea abies*: The same fungi were isolated from needles of diseased trees as in 1946 [see *For. Abstr.* 9 (No. 2560)]. Inoculation of healthy needles with the *Rhizosphaera* and

Phoma species isolated, has not as yet produced infection.

684. DIMOND, A. E., and STODDARD, E. M. **Chemotherapy.** *Proc. nat. Shade Tree Conf.* 1947, 1949 (107-13).

A summary of the recent work done on the control of Dutch Elm Disease through use of 8-quinolinol benzonate [cf. *For. Abstr.* 8 (No. 2113); 9 (Nos. 1893, 2561)] injected into the soil. In general, treatment is successful as a preventive of infection, when applied to healthy trees. Treatment of infected trees causes them to die more slowly than untreated ones, but seldom, if ever, saves them. Experiments are being made with other substances, including auramine and salicylic acid.

685. WHITTEN, R. R. **Control of insect carriers of the Dutch Elm disease and Elm phloem necrosis.** *Trees, Cleveland (Ohio).* 9 (3), 1949 (6, 25).

Recommendations based on recent experiments.

686. BECKER, W. B. **Preliminary spraying experiments to prevent twig feeding by the smaller European Elm bark beetle [*Scolytus multistriatus*].** *Bull. Mass. agric. Exp. Sta.* No. 441, 1947 (41-2).

Sprays of DDT and DDD were applied directly to low branches of living American Elms. At spray concentrations near those used against defoliating insects, prevention of twig feeding of *S. multistriatus* did not last long. More lasting protection was obtained with higher concentrations, but at the cost of considerable injury to foliage.

687. BECKER, W. B. **Use of a mist blower to apply concentrated sprays to Elms to prevent twig feeding by the smaller European Elm bark beetle [*Scolytus multistriatus*].** *Bull. Mass. agric. Exp. Sta.* No. 441, 1947 (42-3).

688. DIEDRICH, J. A., and BALIN, J. **Greenwich report on DDT for *Scolytus*.** *Trees, Cleveland (Ohio).* 9 (3), 1949 (7, 8, 10, 11).

In order to determine the effectiveness of a dormant DDT spray programme on control of the Elm bark beetle under field conditions, plots of 50-100 Elms were selected, at Greenwich, Conn., the trees averaging 24 in. in diameter and 50-75 ft. high. These were sprayed

in groups at rates per tree of 8, 5, 3, 2½, and 2 pints respectively of 12.5% emulsifiable DDT prepared on April 6, and from May 20 onwards twigs were gathered from the top, centre, and base of trees selected at random from the sprayed groups. These twigs were put into glass containers, and a counted number of bark beetles released in each group. Unsprayed twigs were used as controls. The data resulting from this experiment, which are set out in full, seem to indicate that where 5-8 pints of spray was applied per tree no feeding scars were noted and the beetles died within a day. Beetles on unsprayed twigs fed vigorously and lived for 6 days. Applications at a rate of less than 5 pints per tree did not completely prevent feeding, but only shallow feeding scars were noted. Control seemed to be effective from April 6, when spraying was done, till June 9, despite periods of heavy rain.

Observation of the plots during the remainder of the season indicated that trees sprayed with the heavier applications showed no new outbreaks of Dutch Elm disease; in areas of lighter application, disease appeared as usual, though not on so large a scale as was apparent elsewhere in the state.

689. BECKER, W. B. **Sprays to kill scolytids breeding in Elms logs.** *Bull. Mass. agric. Exp. Sta.* No. 441, 1947 (40-1).

At 5% DDT, oil solutions gave 81.5% control, and wettable powder and emulsion sprays about 54% control. The DDD sprays gave no control. Best results were obtainable with the higher concentrations of DDT in oil solution, possibly because of the presence of the oil, which causes mortality by itself when applied in sufficient quantities; and possibly because the DDT was carried down into the bark by the oil and so killed beetles before they could reach the surface.

690. BECKER, W. B. **The control of Elm scolytid infestation by solar heat.** *Bull. Mass. agric. Exp. Sta.* No. 436, 1946 (43).

Merely spreading unfested logs, up to 19 in. in diameter, with bark up to 1½ in. thick, singly, in a north-south position, in the sun, on May 25, and leaving them undisturbed until late October, resulted in 63.2% control. When logs were similarly placed, but turned over on July 12, 79.6% control was obtained. Turning every fortnight from May till October

gave 98.7% prevention. [Cf. *For. Abstr.* 9 (No. 2564).]

45. DAMAGE BY ANIMALS

45.1. Mammals

See also *For. Abstr.* 11 (Nos. 144, 228, 591, 723).

691. COINTAT, M. Le castor rhodanien: extension—dégâts. [The beaver in the Rhone valley: its spread and the damage it causes.] *Rev. for. franç.* No. 1, 1949 (19–29). 10 refs. [F.]

[Cf. *For. Abstr.* 11 (No. 800).]

The beaver [*Castor fiber*] has been protected in France since 1909, seems to be increasing in the affluents of the Rhone, and causes considerable damage to Poplars and fruit trees growing within 50 m. from the river bank.

692. MCCABE, R. A. A winter rabbit browse tally on the University of Wisconsin Arboretum. *Transactions, Wisconsin Academy of Sciences, Arts and Letters, Madison*, 1945, 37, 1947 (15–33 + 4 photos). 5 refs. L.B.M.N.

During 2 winters of similar rabbit density and temperature, but dissimilar snow cover, rabbit browsing was much heavier during the snowy winter.

A browse tally of 108 woody species showed 41% severely browsed and 8% (including *Thuja occidentalis*, *Picea alba* and *Pseudotsuga taxiolia*) unbrowsed. Within a given species browsing ceased when the bark became tough. Large diameter did not discourage browsing and the diameters at which woody species were not eaten varied between species.

Prickles and thorns on plants did not hinder browsing. In the case of cut twigs, 'cured' specimens seemed to be more palatable than green ones in certain species. Broken shoots and branches along paths were readily browsed while unbroken plants of the same species near by were untouched. Palatability varies within a species in different years.

Results are tabulated. *From author's summary.*

693. RUDOLF, P. O. Porcupines' preferences in Pine plantations. *J. For.* 47 (3), 1949 (207–9).

Porcupine apparently prefer *Pinus sylvestris* to other species of Pine, and prefer large vigorous trees. [Cf. *For. Abstr.* 10 (No. 2954).]

45.2. Birds

694. HOLLOWAY, J. T. Damage by kaka in Rimu forests of Western Southland. *N.Z. J. For.* 5 (5), 1948 (1949), (437–8).

Many trees of Rimu (*Dacrydium cupressinum*) in coastal pole forests were found to be unusually scarred. The scars, which have been observed on trees of all size classes from 6 in. d.b.h. upwards, are usually horizontal; the width varies from 0.5 to 3 in. and the length from 2 to 20 in., so that the smaller trees may be almost completely girdled. A single tree may bear 20 or 30 such scars. The bark is cut off cleanly, exposing the wood, but the latter is not torn to any extent. The damage is believed to be caused by birds (*Nestor occidentalis*). No trace of wood-boring or tunneling larvae was found, and it is supposed that bark or sapwood exudates provide the attraction. The scars heal rapidly, and no trees appear to have been killed, but the timber is seriously degraded.

45.3. Insects

See also *For. Abstr.* 11 (Nos. 125, 168–78, 263, 622–3, 685–9).

695. CHRYSAL, R. N. Insect pests in trees [and in converted timber]. *Timber News* 57 (2117; 2118), 1949 (108–9; 146–73 [Imperial Forestry Institute, Oxford.]

696. KURIR, A. Wichtige forstschädliche Insekten. [Important forest insect pests.] Verlag Georg Fromme & Co., Wien. 1947. pp. 39. [G.] Repr. from *Frommes Forstkalender* 75, 1947. I.I.E.

Lists forest insects reported to be on the increase in Austria, with brief notes on the type of damage done by each species and on control measures.

697. [Forest insect investigations in Holland, 1947.] In 'Verslag van de werkzaamheden van het Instituut voor Toegepast Biologisch Onderzoek in de Natuur over het jaar 1947'. *Meded. Inst. toegep. biol. Onderz.* Nat. No. 6, 1948 (7–16). [Du.]

Preliminary first-year results from a study of the role of birds as predators of forest

insects, chiefly in a pure Scots Pine wood, show that: (1) Parent birds select their prey by size, bringing small larvae only to very young nestlings and feeding older nestlings on bigger larvae. (2) The reasons for the selection or rejection of certain insect species as food were not always clear. (3) Of the total number of full-grown *Panolis* larvae in the spring, ca. 40% were eaten by titmice and probably a further 10% by other birds. Birds are estimated to have been responsible for some 33% of the total mortality of caterpillars, sawflies and pupae. (4) In a wood unprovided with nesting boxes: the titmouse population was ca. $\frac{2}{3}$ of that in another wood with such boxes. (5) In December-January birds ate ca. 16% of insects overwintering on branchlets. In the 30 days from Feb. 1 onwards, about 41% of the insect population at the beginning of the period was eaten by birds. Towards the end of winter the insect population on the twigs was nearly exhausted, and mortality among coal tits and gold crests was rather high. (6) A mixed wood was richer in both birds and insects than the pure Scots Pine wood. The relative increase in the bird population, however, was much greater than that of the insects.

In studies of red wood ants only very frequent collection of 'eggs' was noticeably injurious. Artificial establishment of nests in the forest is possible only if the ants can be induced to 'adopt' queens, and experiments on these lines continue. It was confirmed that few insect larvae live on trees heavily overrun by ants, e.g. trees near ants' nests.

Dendroctonus micans was found to attack trees uninfected as well as those infected with root fungus [cf. *For. Abstr.* 11 (No. 715)]. Sitka Spruce was very susceptible to attack, as were *Picea glauca* and *P. orientalis*, and a few Scots Pines showed serious attack. Only in a few cases were the beetles found in Norway Spruce.

Hylobius abietis increased everywhere. Trap logs treated with DDT or 666 were avoided by the beetles, possibly owing to too high a concentration of the insecticides. Further experiments are to be made, including some with odourless DDT and 666.

698. GAROFALO, F. L'azione degli insetti fitofagi sulle variazioni di sostanza secca nelle foglie. [The effect of leaf-eating insects on the variation of dry matter in leaves.]

Nuovo G. bot. ital. (n.s.) 54 (1/2), 1947 (304-15). 7 refs. [It.it.e.] O.B.D.

Leaves of several species of plants (including *Olea oleaster*, *Viburnum tinus*, *Rhamnus alaternus*, *Morus alba*, *Laurus nobilis*, *Cercis siliquastrum*, and *Philadelphus coronarius*) were measured and weighed, both fresh and dry; leaves attacked by insects were compared with untouched controls. The following conclusions were reached:—(1) In leaves whose edges have been notched by insects, the fresh weight per sq. cm. is much the same as that of intact leaves, but the dry weight is less. (2) In leaves notched only on one edge, the fresh weight shows little variation, but the dry weight on the side attacked is less than on the other side and than that of whole leaves. (3) Both fresh and dry weights of perforated leaves are less than those of whole leaves; where only one-half of the leaf is attacked, the dry weight shows little variation.

These phenomena are due to the fact that the traumatic action of the insects provokes a lowering of cellular turgidity in the leaf, and hence a relatively greater concentration of dry-matter elements.

699. DECKER, G. C. Recent developments in insecticides. *Proc. nat. Shade Tree Conf.* 1948, 1949 (38-46).

700. SCANLON, E. H. Concentrated spray mixtures for mist blowers. *Trees, Cleveland (Ohio)* 9 (3), 1949 (14-5).

Includes tables showing forms of DDT and how they are used, quantities to use in making given concentrations of DDT for mist blowers, dilution table for DDT solutions and emulsions made from 25% emulsifiable DDT solution, gallons of 6% DDT solution or emulsion to apply per acre (by mist blower) for various insect pests of trees, and pints of 12% solution or emulsion to apply per tree for other insect pests.

701. BOUCHET, R.-L. La lutte chimique contre les hannetons. [Chemical control of cockchafers.] *Revue horticole, Paris* 31 (2), 1948 (50-5, 57-8). 10 refs. [F.] E.M.B.

A summary of results to date in the control of *Melolontha melolontha* by insecticides. The following recommendations are made: (1) Against adults, suspensions containing 100-200 g. of commercial hexachlorocyclohexane per hl., used during the flight season, are

effective. (2) During the egg-laying period, the ground should be watered with a suspension containing 150 g. of hexachlorocyclohexane per hl. at the rate of 1-2 l./sq. m. (3) Against the larvae, a preparation containing 10% of hexachlorocyclohexane should be applied to the soil at the rate of 100 to 300 kg. [per ha.?] before, during or after working. Alternatively the ground should be sprinkled with a suspension containing 100 g. of hexachlorocyclohexane per hl., at the rate of 5-10 l./sq.m. or 3 l. per linear m.

702. FLEMING, W. E. **Chlordan for control of Japanese Beetle larvae.** *J. econ. Ent.* 41 (6), 1948 (905-12). 1 ref.

Studies begun in 1947 in Moorestown, New Jersey, to find the value of chlordan in controlling the Japanese beetle (*Popillia japonica*) gave the following results:—(1) Freshly applied chlordan appeared to be 70 times as toxic to the larvae as DDT and 7,000 times as toxic as lead arsenate. (2) The velocity of insecticidal action with chlordan increased with the temperature of the soil, a threshold being established at 40° F. (3) The velocity was not modified significantly by the origin or texture of the soil, but was retarded in poorly drained, inadequately aerated soils. Chlordan at 10 lb./acre, applied as late as Aug. 9, eliminated infestations of Japanese beetle larvae in blocks of ornamental nursery stock by mid-September. [Cf. *For. Abstr.* 9 (No. 1291).]

703. MOSSOP, M. C. **Termites in gardens and orchards.** *Rhod. agric. J.* 46 (1), 1949 (17-9). E.M.B.

Includes some advice on how to protect trees and shrubs from termite attack. When transplanting, trees should be planted to exactly the same depth as before, otherwise the termites tend to ring-bark the young tree at soil level. For trees suffering from termite attack Cu SO₄ should be dug into the soil round the tree, but not closer than 18 in. from the trunk, and, with small trees, not more than 4 oz. per tree should be used. It is often found that the dead bark has been removed beneath shelter crusts (usually found on young trees), and the unprotected trunk is thereby exposed to sunscald. The repeated destruction of the shelter crusts is often a sufficient deterrent. If it fails, a spray of 2 oz. lead arsenate to 4 gal. water is usually effective.

704. REEKS, W. A. **White-marked tussock moth as a forest pest.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 5 (1), 1949 (1).

Heavy infestation of *Hemerocampa leucostigma* began in 1946 in the Maritime Provinces and continued until 1948. During the peak of these outbreaks complete defoliation was common, the preferred hosts being White Birch in some localities and Larch in others. Many other deciduous and coniferous trees also were attacked. These records indicate a change in the habits of the insect. Until about 1922 it was primarily a pest of deciduous shade trees in towns and never caused appreciable defoliation in forested areas.

705. McLINTOCK, T. F. **Mapping vulnerability of Spruce-Fir stands in the Northeast to Spruce budworm attack.** *Sta. Pap. Ntheast. For. Exp. Sta.* No. 21, 1949. pp. 20.

Presents three methods of constructing a map showing budworm hazard in mixed Spruce/Fir forests:—(1) from a field survey, checked with cruise data, (2) from cruise data alone, using Westveld's vulnerability formula, and (3) from Fir volume alone. It was found that (3) gave reasonably accurate results at a great saving in time and expense.

706. FETTES, J. J. **Spruce budworm population trends in a section of the Lake Nipigon infestation.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 5 (1), 1949 (2).

Notes on the methods used for estimating budworm populations:—(1) larval index, (2) egg-mass index, (3) defoliation index.

707. MORRIS, R. F. **Budworm population techniques in the Green River project.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 5 (2), 1949 (1-2).

In this project, various methods of estimating budworm populations have been tested, and these are described in some detail as follows:—(1) felling mature trees (typical co-dominants); (2) removing single primary branches throughout the crown height of younger trees, on successive occasions; (3) frass-drop measurement; (4) moth trapping; (5) caged foliage; (6) defoliation estimates. It is concluded that a combination of several techniques is necessary.

708. **Spruce budworm: studies of allied insects in Central Europe.** *Final Rep. Brit.*

Intell. Obj. Sub-Comm. No. 1197, Item Nos. 22, 28 [1947]. pp. 20.

This investigation was undertaken to obtain data on the occurrence and efficiency of biological control agents, especially parasitic insects and diseases, which might prove useful in the campaign against the Spruce budworm in Canada. Little or nothing was found to be known about natural control of *Cacoeia histrionana*. A disease organism was found which attacks *C. murinana* in the pupal stage.

709. [Pruning scars and borer attack.] *Rep. For. Dep. Kenya 1945-7, 1949* (13, 15).

A cerambycid borer (*Caloclytus carinatus*) was found invariably to start its attacks on *Cupressus* spp. in the immediate vicinity of pruning scars that had failed to become occluded rapidly. This failure is attributed to the common practice of pruning trees up to heights of well over 30 ft., thus preventing the development of a crown of sufficient dimensions to keep the trees in healthy condition. This opinion is supported by the fact that trees not pruned high, and left with a good crown, have shown no sign of the borer. Another longhorn, *Oemida gahani*, was found to have much the same habits and to cause damage similar to that produced by *Caloclytus*. It is noteworthy that both of these African species of beetle have taken to exotic softwoods. As a preventive measure, pruning above 30 ft. has been prohibited and it is proposed to adopt rather closer spacing in order to encourage natural pruning.

710. BORUSIEWICZ, A., and KAPUŚCIŃSKI, S. Przyczynek do znajomości rozszedlenia w Polsce szkodników nibyjagód i nasion jałowca pospolitego (*Juniperus communis* L.). [A contribution to knowledge of the distribution over Poland of destructive Arthropoda feeding on the fruits and seeds of the common Juniper.] *Prace rol.-leśn. polsk. Akad. Um.* No. 40, 1948. pp. 22 + map. [Pol.e.] I.I.E.

From injured first- and second-year fruits of Juniper (*Juniperus communis*), collected in forests in various parts of Poland, chiefly in 1945-6, the following pests were identified: *Eriophyes quadrisetus* (Arachnoidea) and *Diaspis visci*, *Chlorochroa juniperina*, *Megastigmus kuntzei* and *Argyresthia praecocella*. Notes are given on their distribution (shown also on a map), and on the type of damage caused by each.

711. CALKINS, L. A. Notes on the Juniper mealybug, *Pseudococcus juniperi* Ehrhorn. *Journal of the Kansas entomological Society, Manhattan* 19 (2), 1946 (66-9). 2 refs. I.I.E.

A description of the Juniper mealybug (*Pseudococcus juniperi*), a pest of ornamental Juniper in Kansas and parts of Oklahoma. It usually attacks first the lower and inner branches of the tree and works towards the top and outwards, causing severe injury or death, marked by the discoloration and fall of the foliage. Populations are lowest in late March, April and early May. The cold of December and January affects the adults, but eggs and nymphs survive the winter. The pest is also found on wild *Juniperus* spp. but no killing of trees in the wild state occurs, and it is thought that parasites and predators exercise a control. As DDT sprays have proved effective, further experiments in their use are under way.

712. CALKINS, L. A. DDT in Juniper mealybug control. *Journal of the Kansas entomological Society, Manhattan* 21 (2), 1948 (60-2). I.I.E.

The Juniper mealybug (*Pseudococcus juniperi*) can be eradicated from heavily infested trees of the Red Cedar [*Juniperus virginiana*] varieties by thoroughly spraying the trunk and foliage with a mixture consisting of 4 oz. of 50% DDT wettable powder plus 2 teaspoons of NNOR (a commercial product containing rotenone) to 1 gal. of water. For protective spraying 2 oz. of the 50% DDT wettable powder can be used to the same amounts of NNOR and water. *From author's summary.*

713. BAYNE, A. Some notes on the defoliation of [Japanese] Larch [by *Hyllobius abietis*]. *Quart. J. For.* 43 (2), 1949 (74-6).

Cf. *For. Abstr.* 10 (No. 735).

714. Reproduction and stand-condition survey in beetle-killed Engelmann Spruce stands. *Rep. Rocky Mt. For. Range Exp. Sta.* 1948, 1949 (29-35).

A survey was made in the White River National Forest, Colorado, where 96-99% of Engelmann Spruce over 7 in. in diameter has been killed by *Dendroctonus engelmanni*. The objects were:—(1) to determine the number of seedlings, saplings, and trees left after beetle infestation has subsided; (2) to determine how

much of the stand under 7 in. d.b.h. was living; (3) to determine what proportion of the living stand is destroyed in the process of removing beetle-killed timber by various logging methods; and (4) to map those areas where artificial regeneration will be necessary. The data obtained are given in a series of tables. Although practically all Spruce of 8 in. d.b.h. and over had been killed, there remained an abundant understorey of advance growth of Spruce and Alpine Fir. It was found that, on the average, logging destroyed 62% of Spruce and 48% of Fir advance growth, or an average of 54% of both species. Very little seed is available from seed trees, so that conservation of the advance growth is of the utmost importance. Horse skidding of 100-in. pulpwood caused least loss (23%), followed by ground skidding of full-length trees by light tractor (42.4%), ground skidding of short logs with D-4 Caterpillar crawler-type tractor without dozer equipment (62.6%) and skidding of short logs with dozer-equipped TD-5 International crawler-type tractor drawing a light home-made sulky (67.9%).

It was found that successful beetle attack was correlated with size of tree. The proportion of the stand killed in the 2-, 4-, 6-, and 8-in. diameter classes was found to be 1.1, 10.0, 30.0, and 52.0% respectively.

The survey showed that only a small proportion of the trees under 8 in. d.b.h. produced cones (2, 17, and 64% respectively for trees of 4-, 6-, and 8-in. classes).

715. GYÖRFI, J. Óriás fenyőhancsszű (*Dendroctonus micans* Kug.) Zalában. [*Dendroctonus micans* in the county of Zala.] *Erdész. Kisérl.* 48 (1/2), 1948 (32-44). 11 refs. [Hu.G.]

Describes a considerable infestation of *Dendroctonus micans* in the county of Zala in 1947, the first severe attack recorded in Hungary. The victims were Spruce, which were already suffering, almost without exception, from attack by *Fomes annosus* [cf. *For. Abstr.* 11 (No. 697)]. The author discusses the occurrence of *D. micans* as a primary and secondary pest of trees and gives an account of some characteristics of the beetle and its life history. To the known parasites of *D. micans* the author adds from his own observations the following:—*Platysoma angustatum*, *Epuraea laeviuscula*, *Rhizophagus ferrugineus*, *Raphidia*

ophiopsis, *Dinotus bidentatus*, *Rhopalicus maculifer*, *Xylonomus irrigator*, *Lonchaea laticornis* and *L. vaginalis*. The best protection, he concludes, is to maintain the stand in a healthy condition.

716. ERDŐS, J. Fenyőtobozokbau éi új fajok az *Eutelus*-félék (Hymen., Chalc.). Között. [New species of the *Eutelini* (Hym. [Pteromal.]) living in cones.] *Erdész. Kisérl.* 48 (1/2), 1948 (1-9). [Hu.Latin.]

Describes a new genus, *Platythorax*, type species *Eutelus piceae*, with two new species, *P. conobius* and *P. hungaricus*, both inhabiting cones of *Picea abies*.

717. ZARCO, E. El género *Pissodes* German en España. [The genus *Pissodes* in Spain.] [*Bol.*] *Inst. for. Invest. Exp. Madrid* 20 (42), 1949. pp. 35 + 6 plates. [Span.]

An account of the genus *Pissodes*, usually a secondary pest attacking diseased or damaged conifers, but one which can also spread to healthy trees. Artificial stands are much more liable to attack than natural ones. Trees between 15 and 25 years old, growing in medium or extreme continental climates, and particularly those in excessively dense stands, are very susceptible. Elimination of diseased or damaged trees is the best preventive measure. An attack can be recognized by the presence of woodpeckers in the forest and by the yellowing of terminal shoots as well as by the usual tunnels in branches and cones. In Spain preventive measures include inspections during February and October, elimination and burning of affected trees, or isolating them and setting traps, dusting with DDT or Gam-mexane-base insecticides, or ringing the trunks with a sticky paste. Some methods of setting traps are described.

718. SIMPSON, L. J. Control of White Pine weevil with DDT. *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 5 (1), 1949 (1).

Preliminary tests have shown that *Pinus strobus* can be protected from weevil [*Pissodes strobi*] attack by the application of a concentrated DDT spray with a knapsack fire pump fitted with a fire-spray nozzle. Fifty trees about 6 ft. high were sprayed in a plantation and an equal number selected as controls. When the entire stem was sprayed with wettable powder at the rate of 50 lb. DDT 100 gal.

water, there was no attack in the following summer, whereas 30% of the controls were attacked. The spray was applied just before beetle emergence during the last week of May. Further tests are needed to determine whether lower concentrations can be used and whether spraying the upper part of the stem would suffice.

719. MOWAT, E. L. **Selection cutting reduces Ponderosa Pine losses at Pringle Falls.** *For. Res. Notes Pacif. Northwest. For. Range Exp. Sta. No. 45*, 1948. pp. 3.

Average volume loss from insects and related causes on selectively cut areas was 8.2 bd. ft./acre compared with 49.7 bd. ft. in neighbouring uncut forest.

720. DAVIAULT, L. **Pine bark aphid (*Pineus strobi* Htg.).** *Bi-m. Progr. Rep. Insect Invest. Dep. Agric. Can.* 5 (2), 1949 (2).

This aphid has recently become unusually important in Quebec and occurs on White Pine throughout its range. In heavily infested stands, a large proportion of trees are also attacked by wood-borers. The aphid population is denser on parts exposed to the north and west, and more abundant in stands where there is little ventilation or light.

721. RAWLINGS, G. B. **Recent observations on the *Sirex noctilio* population in *Pinus radiata* forest in New Zealand.** *N.Z. J. For.* 5 (5), 1948 (1949), (411-21). 2 refs. [Paper read at 7th Pacific Science Conference, Auckland, Feb. 1949.]

The author first gives a general account of the life history of *Sirex* spp. and their symbiotic association with *Stereum* spp. of fungus. [Cf. *For. Abstr.* 4 (188).]

The most important single factor predisposing a tree to attack by *S. noctilio* appears to be that the tree should have a light open crown of less than $\frac{1}{4}$ its height. Other predisposing factors are exposure to full sunlight, high temperature, and the smell of resin resulting from silvicultural operations between January and March. Once a tree is attacked, the attraction for *Sirex* is increased by the smell of resin exuding from the punctures.

The main injury to trees attacked is from the symbiotic fungus, resembling a species of *Stereum*, which is injected by the female wasp within the oviposition puncture. The hyphae attack the living tissue and wood of the tree.

With mass attack, the wedges of infection unite and the portion of the tree above is killed by the cutting off of its water supply. Some trees appear to be able to deal with attacks by occlusion, in others the trunk may be killed in strips. The fungus causes a white rot of the wood, and decay is very rapid. No sporophore has been found on trees attacked by *S. noctilio*, which gives a culture similar to that invariably obtained from near *Sirex* oviposition punctures. Attempts to secure sporophores in flask cultures have, so far, failed, and it appears probable that the fungus is propagated only through *Sirex*.

Notes are given of observations on several mass attacks. *Sirex* does not appear to breed in slash, but prefers live, standing trees. Ideal conditions are provided by felling operations, where unmerchantable trees are left standing in a narrow strip between felling areas. Logging roads and the newly exposed edges of areas not cut, provide additional breeding grounds.

In the light of the present state of knowledge, the following provisional recommendations are made for silvicultural methods of control:— (1) Provide for clear felling and the salvage of dying trees. (2) Refrain from thinning and pruning operations between December and March. (3) Prescribe frequent, light thinnings rather than thinnings too heavy and too late. (4) Do not expose stands of Pine by making fellings on the northern (sunny) face. (5) By thinnings, maintain good crowns exceeding one third of the total height of the tree.

The possibilities of biological control of *Sirex* are briefly discussed. The parasite *Rhyssa persuasoria*, introduced from England, was successfully reared and liberated in 1929 and 1931, and is now well established. Its habits and life history are described. It seems unlikely to parasitize *Sirex* heavily enough for effective control. It had been doubted whether it would parasitize at all in N. Zealand, since it normally parasitizes only 2nd- or 3rd-year larvae, and the life cycle of *S. noctilio* in N. Zealand is said to occupy only 10-13 months instead of the usual 2-3 years. However, as it has been found that *Rhyssa* oviposits readily in larvae 8-9 months old, and as these larvae are almost full grown, it is possible that *Rhyssa* will complete development.

722. HEQVIST, K.-J. **Några iakttagelser över tallmätarens parasiter under senaste**

härjningen i södra och mellersta Sverige (1943–1945). [Some observations on parasites of the Pine looper [*Bupalus piniarius*] during the latest outbreak in South and central Sweden.] Medd. SkogsforsknInst., Stockh. 37 (3), 1948. pp. 18. 42 refs. [Sw.sw.g.]

Telenomus phalaenarum and *Trichogramma evanescens* were parasitic on the eggs and increased during the last 2 years; in the Hökensås district, the number of eggs parasitized by *Telenomus* rose from 32.1% in 1944 to 47.9% in 1945, and by *Trichogramma* from 9.5 to 19.1%. The following species were obtained from larvae and pupae: *Cratichneumon nigrarius*, *Heteropelma calicator*, *Anomalonia biguttatum*, *Lydella nigripes*, *Barichneumon locutor*, *Mesochorus politus*, *Euceros pruinosis*, and *Carcelia rutilla*, the first 4 occurring most frequently. *Euceros pruinosis* has not been obtained from the Pine looper before. *Mesochorus politus* occurred as a parasite on *Lydella nigripes*. The number of parasitized larvae and pupae increased considerably in 1944–5; in Hökensås it rose from 17% in 1944, to 47% in 1945. The increase was especially striking in the dusted area at Hökensås, viz. from 17% (1944) to 71% (1945), as against 44% in the untreated area. Only those parasites which were swarming at the time of dusting would be affected by DDT.

Results of the investigation are given in graphs and tables. From author's summary.

723. [Damage to Pine plantations in Kenya.] Rep. For. Dep. Kenya 1945–7, 1949 (13, 15).

The Pine emperor moth, *Nudaurelia cytherea* var. *capensis*, has been found damaging Pines in Kenya. Control is only possible in the chrysalis stage, which is spent underground, but this is rendered more difficult in Kenya, where the pupal period averages only 7 weeks compared with 22 in South Africa. A further factor favouring the insect is the prevalence of the Pepper Tree, *Schinus molle*, one of the most commonly cultivated species in the Colony. In S. Africa the favoured method of control is to loose domestic pigs in Pine plantations at the rate of about one pig per 3 acres, and the pigs then rootle and eat the chrysalises. In Kenya, however, where wild pigs were found to have come in large numbers

to an infested plantation, they had also uprooted many young trees.

724. JOHNSON, P. C. Natural decline of tussock moth infestations in the inland empire. Abstr. in Northw. Sci. 22 (1), 1948 (16). A.P.B.

Outbreaks of the tussock moth (*Hemerocampa pseudotsugata*) in Washington and Idaho in 1947 were completely checked, by the time the larvae had reached their final instars, by the incidence of parasitism and the effects of a polyhedral virus disease. [Cf. For. Abstr. 9 (No. 1908).]

725. EVENDEN, J. C., and JOST, E. J. Tussock moth control [on Douglas Fir], North Idaho, 1947. U.S. Bur. Ent. [1948?], pp. 27 + [8] + 15 photos.

Cf. For. Abstr. 9 (Nos. 1908, 2574).

726. DALLIMORE, W. A serious scale insect on Yew. Quart. J. For. 43 (2), 1949 (79).

A widespread infestation of Yew by a scale insect has recently occurred in England, for which the hot summer of 1947 is held to be responsible. Identified as *Pulvinaria vitis* var. *ribesiae*, the insect has not previously been noted on Yew.

727. NEISWANDER, R. B. The grape mealybug on *Taxus* in Ohio. J. econ. Ent. 42 (1), 1949 (41–4). 4 refs. [Ohio Agricultural Experiment Station, Wooster.]

Since 1943 the grape mealybug (*Pseudococcus maritimus*) has become a troublesome pest on all species of *Taxus* in Ohio. Observations were made on the life history of the insect on 3 heavily infested plants of *T. brevifolia*. Two generations occur annually, eggs being deposited during the latter half of June and during September and October in large masses of white fibrous material which protects them from most contact insecticides. Field experiments show that the latter half of May and the first half of June and August are the best spraying seasons. In Ohio both parathion and thiocyanate produced excellent results when used in two applications at 10-day intervals beginning during the latter half of May or early in June.

728. MACGILLAVRY, D. Insecten op Amerikaanse eik en op tamme kastanje. [Insects on American Oak and Sweet

Chestnut.] *Entomologische Berichten, Amsterdam* 12 (275), 1947 (137-43). [Du.] I.I.E.

Lists the insects recorded in different parts of Holland as occurring on *Quercus borealis* and *Castanea sativa*.

729. NAUDÉ, T. J. **Research into the control of insect pests.** *Fmg. S. Afr.* 24 (275), 1949 (105-13). 25 refs. E.M.B.

Contains a short section on forest insect pests in South Africa. Extensive dying-out of *Acacia karroo* is not directly traceable to insects, but large numbers of cerambycid beetles (*Zographus oculator* and *Ceroplesis thunbergi*) have been found ovipositing heavily on moribund trees and hastening defoliation by ring-barking the shoots in feeding. The ecological study of the Wattle bagworm has enabled reliable predictions of outbreaks to be made. An oil-base aerial spray, which should be partially rain-proof, is being investigated.

730. PETERSON, L. **Tree seed insects.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 5 (2), 1949 (3).

Further studies were made of *Caragana* seed chalcid [cf. *For. Abstr.* 10 (No. 760)], and notes are given on its biology and behaviour. Further evidence confirmed an earlier conclusion that early blooming were more heavily attacked than late blooming trees. Of the 10 species of *Caragana* included in this investigation, *C. arborescens*, *C. frutescens*, and *C. pygmaea* were preferred for oviposition.

The dehiscence of *Caragana* seed pods was investigated, to ascertain the dispersal of this chalcid in the larval stage. It was found:—(1) for trees 5½–11½ ft. high, very few seeds were scattered further than 17 ft. from the base of the parent trees; (2) more than 80% of all seeds were dispersed not more than 5 ft. from the base of the parent tree; (3) infested seeds, though only one-half the weight of uninfested seeds, had a very similar range and pattern of dispersal.

731. [Control of *Gonipterus scutellatus*.] *Rep. For. Dep. Kenya* 1945–7, 1949 (13).

The Eucalyptus leaf weevil appeared in plantations in several parts of Kenya, but is being successfully controlled by the introduction of a mymarid parasite, *Anaphoidea nitens*, which has distributed itself widely.

732. ZECK, E. H. **Weevils associated with the bud-fall of *Eucalyptus sideroxylon*.** *Agricultural Gazette of New South Wales, Sydney* 57 (6), 1946 (312-3). L.S.

A brief account of an infestation of weevils on *Eucalyptus sideroxylon* in western New South Wales. Insects from the Mudgee area were identified as *Haplonyx longipilosus*, and larger ones from Gilgandra as *H. spencei* and *Oxyops gemella*. Dropping of the unopened flower buds was caused by a puncture near the base.

733. SCHEDL, K. E. **Starker Weiden-bohrerbefall an Esche.** [Severe goat-moth attack on Ash.] *Zbl. GesGeb. Ent.* 1 (2), 1946 (59-63). [G.] I.I.E.

Briefly describes attacks by *Cossus cossus* on pollard Ash trees round the barrack square of the Stenay prisoner-of-war camp, Verdun, observed in 1945 during the author's internment there. The attacked stems showed canker-like swellings, from which in many cases the bark had fallen away. The crowded larval feeding tunnels ran mostly horizontally between the bark and wood, leaving deep grooves in the sapwood. Here and there long tunnels, made by the full-grown larvae for overwintering and pupation, ran more or less steeply into the wood. For some years the trees had been whitewashed to a height of 1.5 m., presumably to render them visible in the black-out. As active attacks at the time of observation were practically confined to the root spurs and exposed roots, below the whitewashed butt, it is thought that whitewashing may repel ovipositing females. The initial opportunity for the attacks may have been created by a weakening of the trees as a result of repeated pollarding.

734. **Two Poplar aphids.** *Bulletin of the Brooklyn entomological Society, Lancaster (n.s.)* 42 (2), 1947 (71). I.I.E.

A brief account of unusually severe infestations of Poplar in Uintah County, Utah, in 1945, viz. *Mordvilkoja vagabunda* galls on *Populus sargentii* and *Thecabius populi-conduplicifolius* on *P. occidentalis*.

735. SMITH, C. C. **A new method of controlling the satin moth.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 5 (1), 1949 (1).

Stilpnotia salicis, which defoliates ornamental Poplars and Willows in Eastern Canada, can be effectively controlled by spraying only the trunks with DDT spray. Eggs are laid mostly in the bark of the trunk, and the spray should be applied, to a height of about 30 ft. on large trees, when the larvae begin to hatch from the eggs (about August 5-10 in New Brunswick).

736. [Defoliation of *Gmelina arborea* by *Calopepla leayana*.] Rep. Wkg. Plans Silv. Ent. For. Dep. Burma 1945-6, 1949 (39).

Areas in the Northern Shan States, planted with *Gmelina arborea* in 1928-32, and subsequently abandoned because of the attacks of the defoliator, *Calopepla leayana*, were re-examined during 1945-6. It was found that, where the trees had survived defoliation, they had flourished and the crop was now unduly congested and needed thinning. The present incidence of the pest appears to be negligible.

737. Pests of Teak: *Xyleutes ceramica* Walk., the beehole borer. Rep. Wkg. Plans Silv. Ent. For. Dep. Burma 1940-1, 1949 (69-76).

Life history and natural enemies.

738. [*Indarbela* [quadrinolata?]: life history and alternate hosts.] Rep. Wkg. Plans Silv. Ent. For. Dep. Burma 1940-1, 1949 (78-81).

This pest is of importance, since it is an alternate host of *Nemeritis tectonae*, a parasite of the beehole borer. Its polyphagous habits are likely to be of considerable assistance in establishing *N. tectonae*.

739. *Nemeritis tectonae*, parasite of *Xyleutes ceramica*, the beehole borer of Teak. Rep. Wkg. Plans Silv. Ent. For. Dep. Burma 1940-1, 1949 (85-6).

The technique of breeding this parasite in the insectary was so greatly improved as to encourage hopes of achieving it on an economic scale. The relationship between stem girth of the tree and parasitism % of the beehole borer was further confirmed, graphs showing this to be inverse. In some areas the rate of parasitism in 2- and 3-year-old shoots on the top branches is as much as 90%, falling towards the main stem where it sinks to 10-15%.

45.4. Other Animals

740. VIGGARS, P. M., and TARJAN, A. C. A new root disease of Pin Oaks possibly caused by the nematode *Hoplotaimus coronatus* Cobb. Plant Dis. Repr. 33 (3), 1949 (132-3). A.P.B.

A new and virulent disease of Pin Oak (*Quercus palustris*) in Wilmington, Del., is characterized first by hypersensitivity of the tree to drought and a chlorotic appearance of the foliage on affected limbs. Later, necrosis of the margins of affected leaves occurs and spreads inwards, killing the leaves and sometimes causing premature abscission. An affected tree may therefore have one or more live but barren limbs. On the trunk pronounced growth fissures appear, and the formation of callous tissue over wounds is twice as rapid as on normal trees. In the advanced stages of the disease epicormics are formed and the stem of the crown develops a fluted condition. The symptoms may spread slowly or appear generally throughout the tree in one growth season. Widespread killing of root hairs and fibrous roots is another important symptom, and two-root pathogenic nematodes, *Hoplotaimus coronatus* and *Pratylenchus* sp. were found in considerable numbers in roots of a tree which had nearly died and had been considerably restored by the addition of large amounts of organic matter and fertilizer to the soil. Subsequent observations of 20 affected seedlings yielded *H. coronatus* in 18 cases. It is considered possible that this nematode may be the cause of the disease, or closely connected with it.

46. DAMAGE BY MAN

See also For. Abstr. 11 (Nos. 410, 714).

741. HEPTING, G. H., ROTH, E. R., and SLEETH, B. Discolorations and decay from increment borings. J. For. 47 (5), 1949 (366-70).

Presents data from the north-east United States. It was found that increment borings result in extensive discoloration, and sometimes decay, in many of the hardwoods, particularly the diffuse-porous species. Borings should be kept to a minimum, and the holes should be made as near the ground as practicable, to minimize the damage to the butt log.

47. INJURIES OF ALL KINDS TO INDIVIDUAL TREE SPECIES

See also *For. Abstr.* 11
(Nos. 265, 661, 667, 740).

742. CHURCH, T. W., JR. **Effects of defoliation on growth of certain conifers: a summary of research literature.** *Sta. Pap. Ntheast. For. Exp. Sta.* No. 22, 1949. pp. 12. 19 refs.

743. TOOLE, E. R. **White Pine [*Pinus strobus*] blight in the Southeast.** *J. For.* 47 (5), 1949 (378-82). 13 refs.

White Pine blight has increased rapidly in the south-eastern U.S. in recent years. Some of the possible causes of this disease are discussed, and needle fungi have been eliminated as a likely factor. Further work is needed to determine the significance of root fungi and root aphids, the latter either as a primary

cause or as vectors of a virus. *From author's summary.*

744. MILLER, P. W., SCHUSTER, C. E., and STEPHENSON, R. E. **Diseases of the Walnuts in the Pacific Northwest and their control.** *Sta. Bull. Ore. agric. Exp. Sta.* No. 435, 1945 (repr. 1947). pp. 42.

745. GRASSO, V. **Importanti modificazioni morfologiche di un melo selvatico. [Important morphological modifications of a Crab Apple.]** *Nuovo G. bot. ital. (n.s.)* 54 (1/2), 1947 (279-89). 6 refs. [It.it.f.] O.B.D.

Describes the morphological and anatomical modifications, including callus formation on wounds, and natural grafts of a Crab Apple [*Pyrus malus*] growing on a mountain in a very unfavourable environment subject to extremes of heat and cold. The agents causing these abnormalities of structure, foliage and development, are wind, heat, cold, and damage by animals, particularly cattle. *From author's summary.*

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

See also *For. Abstr.* 11 (No. 781).

52.3. *Form. Taper*

See also *For. Abstr.* 11
(Nos. 750, 758-9, 768).

746. MATTE, L. **The taper of coniferous species with special reference to Loblolly Pine.** *For. Chron.* 25 (1), 1949 (21-31).

The author first reviews the methods hitherto developed to express the form of the tree stem, points out that none of them describes the entire length of the stem, and then presents and discusses his own formula

$$y = x \sqrt{ax^2 + bx + c}$$

where x denotes the distance from tip to any section as a proportion of the entire length from tip to breast height; y denotes the corresponding diameter as a proportion of d.b.h. inside bark; and a , b , and c are constants for a species. Values of a , b , and c are given for Loblolly and White Pine and Balsam Fir. The influence of tree size on stem-form is also discussed.

747. JOHNSON, F. A., and ENGSTROM, W. **Taper tables for Western Hemlock [*Tsuga heterophylla*].** *Res. Notes Pacif. Nthwest. For. Range Exp. Sta.* No. 51, 1949. pp. 5.

52.4. *Measurement of Volume*

See also *For. Abstr.* 11
(Nos. 219, 776).

748. Nya mättningsbestämmelser för massaved. [New [Swedish] scaling rules for pulpwood.] *Skogen* 35 (21), 1948 (245). [Sw.]

749. SCHAEFFER, L. **Tarifs rapides et tarifs lents. ['Rapid' and 'slow' volume tables.]** *Rev. for. franç.* No. 1, 1949 (7-13). [F.]

The author points out some of the weaknesses of Algan's so-called 'universal' volume tables, which are much used in France. In particular, the assumption that e.g. a tree doubles its volume when its diameter increases from 20 to 25 cm., is not true of highly homogeneous stands, and he proposes a modification in the basic formula for the construction of tables more suited to small homogeneous stands. Such tables are given (a) for diameters from 0-15 to 1 m., and (b) for girths from 0-4 to

3 m., for 20 different classes of stand based, like Algan's, on the volume of a tree of 45 cm. d.b.h.

750. PATRONE, G. Sulla costruzione delle tavole cormometriche. [On the construction of volume tables.] *Ital. for. mont.* 4 (1), 1949 (49-50). [It.]

Criticizes a paper by L. Schaeffer [cf. *For. Abstr.* 10 (No. 2310)] which proposes the use of a coefficient of taper for the construction of volume tables for stands of uniform height. The author considers that this method can be usefully employed only in those cases where the influence of height on coefficient of taper is negligible; that is to say, when merchantable length varies only between narrow limits.

751. BELLOUARD, P. Note sur le volume ligneux de la forêt primaire de Côte d'Ivoire. [Note on the growing stock of the primary forest of the Ivory Coast.] *Rev. int. Bois* 16 (142), 1949 (77-9). [F.]

Measurements made on a sample plot of 3.8 ha., of average richness, gave a total volume in the round of about 360 cu.m./ha. of which only 40 cu.m. is contributed by sawlogs of commercially recognized species and another 76 cu.m. by other species of commercial size. For purposes of calculation in this type of forest the formula $V = KSH$ (where V = volume in cu.m., H = total height in m., K is a form factor, and S = sectional area at breast height (or beginning of buttresses) in sq. m., is suitable. The value of K varies with species, but a mean value of 0.7 for the whole stand gave reasonably good results.

The 33 species composing the stand are represented in very different proportions. Of 199 trees measured, 124 or three-fifths, belonged to 3 species: *Strophonema pseudocedrela*, *Distemonanthus benthamianus*, and *Pachylobus deliciosa*, which represented half the volume of sawtimber. On the other hand, 10 trees belonging to 9 species, of which 7 were represented by a single specimen, by themselves produced a volume of 96 cu.m.

752. KALLSTENIUS, L. Försök med fältstansning av hålkort vid domänverkets skogstaxeringar. [Experimental field punching of perforated cards in the Swedish Forest Service's enumerations.] *Skogen* 36 (2), 1949 (19-20). [Sw.]

When using machine-handled punched cards for working up sample-plot data, about 70% of the time and cost of the whole procedure is that of transferring tally data to the cards, and this phase of the process increases the risk of mistakes. Punching tools suitable for field use came on the Swedish market in 1947 and in 1947-8 the Forest Service experimented with direct punching of cards in the field. The cards used were of special cardboard, cross-laminated to minimize shrinkage and swelling.

To improve the accuracy of punching, they were pre-perforated with small guide holes for a seeker attachment on the punch, which works only if the seeker engages in the hole. As the punch holes are larger than those made by a machine punch, only alternate columns of the card can be used; thus in the present instance 16 columns of a 36-column card were used for hand punching in the field, a few columns at one end being reserved for data (e.g. district and forest) common to whole bundles of cards, which could therefore be machine-punched very cheaply at headquarters. Cards were carried in the field in a special container having a shoulder strap, holding ca. 300 cards (some 2-3 days' requirement) and weighing 0.6 kg. when full. A card was used for each tree over 10 cm. in d.b.h. In addition, the card for the first tree measured on a plot was punched with a special distinguishing hole and with data common to the plot as a whole.

The trial, which involved surveys of ca. 9,500 ha., was entirely satisfactory. As measuring is the longest job, officers had ample time to punch the cards as measurements were called out, and the work went at least as quickly as that of ordinary tallying in neighbouring tracts. It is estimated that costs of the whole process of obtaining and working up the data were reduced by about one-half. There was no increase in field errors as compared with tally writing. In spite of rainy weather the cards functioned perfectly in the sorting machines, showing no significant wear or deformation. In the rare event of a card's becoming defective, it would be rejected by the machine and a substitute card could be prepared. [Cf. *For. Abstr.* 11 (No. 275).]

753. JOHNSON, F. A. Statistical aspects of timber-volume sampling in the Pacific Northwest. *J. For.* 47 (4), 1949 (292-5).

The author analyses statistically the data

derived from 25 randomly selected sampling units, each consisting of 5 $\frac{1}{8}$ -acre circular plots at intervals of 2 chains in a straight line, in uncut sawtimber in Jackson County, Oregon, in order to determine the number of sampling units, and the number of plots per sampling unit, required for a given degree of accuracy. The results indicate that one sampling unit consisting of all 5 plots is capable of supplying the same amount of information as 2.27 sampling units consisting of a single plot, and that 100 sampling units consisting of all 5 plots are as good as 130 sampling units consisting of 3 plots at 2-chain intervals. For practical reasons, however, units consisting of fewer than 4 plots are to be used in future work.

53. SOLID CONTENTS OF STACKED MATERIALS

754. NICKERSON, D. E. **A possible source of error in determining converting factors for four-foot wood.** *Silv. Leaf. For. Serv. Can.* No. 30, 1949. pp. 2.

In order to determine whether the work of measuring end diameters on both faces of a stack of 4-ft. pulpwood was justified, both ends were measured, and the volume calculated on the basis of the wood surface of each end separately. In this case, the use of measurements from one face only would have introduced errors ranging from 1% to 4.5%, owing to the consistently higher results obtained from the side facing the hauling road. The explanation is apparently that the average workman is more likely to pile wood with the butts towards him than away from him. The measurement of both sides of all piles in a sample is therefore necessary if reliable converting factors are to be obtained.

54. FACTORS CONNECTED WITH ASSORTMENT

See also *For. Abstr.* 11 (Nos. 373, 748).

755. GUILKEY, P. C. **Cordwood in tops of conifers and Aspen in the Lake States.** *Tech. Notes Lake St. For. Exp. Sta.* No. 315, 1949. p. 1.

A table of factors for determining the volume of cordwood in the tops of sawtimber trees from bd. ft. stock tables.

756. STAEBLER, G. R., and SHAW, E. W. **Cordwood volume tables for second-growth Douglas-Fir.** *Res. Notes Pacif. Nthwest. For. Range Exp. Sta.* No. 52, 1949. pp. 2.

757. ZEHNGRAFF, P. **When does a Red Pine reach highest value?** *Tech. Notes Lake St. For. Exp. Sta.* No. 311, 1949. pp. 2.

A graph shows the value of a *Pinus resinosa* tree in dollars at different heights and ages when exploited (1) as pulpwood, (2) as logs and pulpwood, and (3) for utilization of all products.

55. AGE

758. BAAS BECKING, L. G. M. **Notes on jungle trees I.** *Chron. Nat.* 104 (10), 1948 (271-7). 18 refs. [E.] E.M.B.

Deals with age estimates, made by the author and A. M. Neervoort, for trees in the Tjibodas 'Mountain Gardens', Java, to establish the nature of this area, which is claimed by some to be virgin forest and appears from the present investigation to have remained for at least 200 years undisturbed. The bulk of the paper is devoted to a mathematical examination of the relations between age, height and diameter. For the age/height relationship the formula used by Ferguson [*Tectona* 30, 1937 (235)] is taken as a basis, and values are deduced for maximum height and its relation to a factor (*c*) which is inversely proportional to growth rate and indicates the age at which a tree reaches 0.9 of its maximum height. Diameter correlations with age are less reliable than the age/height relationship. The diameter/height relationship is considered, and equations derived, using Greenhill's theoretical work on 'the greatest height to which a tree of given proportions can grow' [*Proc. Cambr. phil. Soc.* 4, 1881 (65)], which relates maximum height to a form constant (*n*), diameter, Young's modulus of elasticity, and specific gravity of the wood. Values are tabulated in an appendix for maximum height, maximum diameter, estimated maximum age, and the constants (*c*) and (*n*), for about 40 tree species of the Tjibodas area. A preliminary examination of data on the physical properties of the wood of 9 species included in this study indicates a significant relationship between these properties and maximum tree height. Treatment of this question, however, is reserved for a further paper.

56. INCREMENT

See also *For. Abstr.* 11 (Nos. 87, 768).

759. ARNOLD, D. L. **Growing space ratio as related to form and development of Western White Pine.** *Abstr. of thesis, in J. For.* 47 (5), 1949 (370). [School of Forestry, University of Idaho, Moscow, Idaho.]

Sample data from 4 pole and sapling stands of *Pinus monticola* in north-central Idaho were analysed to determine the relationships existing between various tree and growth characteristics. Significant or highly significant correlations were found between growing-space ratio (the quotient of crown spread in feet divided by d.b.h. in inches) and current growth rate, but less than 50% of the variation in current growth rate was attributable to changes in the ratio or in the % of live crown.

A crown-area index was derived by multiplying crown width by crown length. Correlation between crown-area index and current annual increment in basal area, was highly significant and ranged from 0.86 to 0.94. About 75-90% of variation in growth was explained by changes in crown-area index. On the basis of the data, crown area is a much better index of growth rate in young Western White Pine than either growing-space ratio or % of live crown. A table was prepared showing crown-area indices required for varying rates of growth.

760. JOERGENSEN, C. **Increment percentage—its usefulness and a simplified method of computation.** *Pulp Paper Mag. Can.* 50 (2), 1949 (75-8, 80).

The increment percentage is a valuable indicator of the productivity of single trees, a stand, or any unit which is uniform in some respect, i.e. age class, diameter class, species etc.

A method is described by which the increment % can be calculated directly from data obtained by the increment borer and the caliper, without reference to the volume. It is computed according to a formula analogous to the simple interest formula. The error introduced by this simplified method is small enough to be of little account in practical work. *From author's summary.*

761. TRYON, H. H., and FINN, R. F. **On obtaining precise diameter measurements**

on hardwoods using the dial gauge. *J. For.* 47 (5), 1949 (396-7).

Previous articles have described the use of the dial gauge dendrometer for making radial measurements on conifers [cf. *For. Abstr.* 8 (No. 2794)]. The present article describes a technique for making similar measurements on hardwoods.

762. SMITHERS, L. A. **A simplification of the continuous inventory method of calculating diameter growth [by the use of cumulative stand tables].** *Silv. Leaflet. For. Serv. Can.* No. 31, 1949. pp. 2.

763. BUCKMAN, C. B., and GORMAN, E. J. **A method of determining timber growth.** *J. For.* 47 (5), 1949 (399-400).

Describes the method of constructing a table which shows the increases in cords for each increase in d.b.h., for Black Spruce (table given as example) and Jack Pine.

764. WITTE, A. **Löpande tillväxtens värde hos ek. [The value of the current annual volume increment of Oak.]** *Skogen* 35 (20), 1948 (231). [Sw.]

Presents curves, based on 1945 timber prices and current logging costs, to show the value as standing timber of the c.a.i. of Swedish Oak [*Quercus robur sensu lato*] for size classes between 20 and 65 cm. d.b.h., suitable for conversion to A-grade and veneer logs.

765. STALLINGS, W. S., JR. **Dating prehistoric ruins by tree-rings.** *The Tree-ring Society, University of Arizona, Tucson, Arizona.* 1939, rev. 1949. pp. 18. 26 refs. Price 35 cents.

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

See also *For. Abstr.* 11 (No. 219).

766. SMITH, L. F. **Thirty-five years of development in second-growth Longleaf.** *Sth. Lumberm.* 177 (2225), 1948 (149-52).

A study of a typical second-growth Longleaf Pine [*Pinus palustris*] stand, well stocked but untended, and about 35 years old, on the McNeill Experimental Forest in Pearl River County, Mississippi. Tables include average diameters and heights, basal area and volume of merchantable trees, average annual growth and stumpage value in the years 1928, 1933, 1938 and 1947, on 4 types of plot:—(1) unburned and ungrazed, (2) unburned and

grazed, (3) burned and grazed and (4) burned and ungrazed. The annual burning definitely retarded growth; grazing did not.

767. BALDWIN, H. I. [Growth and yield of] some older White Pine plantations in New Hampshire. *J. For.* 47 (5), 1949 (397-9).

768. MORVILLE, K. Skovfytrens Vækst og Form. [Increment and form of Scots Pine [in the Tisville-Frederiksværk Forest District, Denmark].] *Dansk Skovforen. Tidsskr.* 38 (12), 1948 (545-60). [Dan.]

Since Scots Pine is comparatively little grown in Denmark, data on its growth are scanty and inadequate. The author therefore presents the results of his mensurational work in Tisville, where there are ca. 800 ha. of this species, giving a stem-form-factor curve and, for each of the 5 quality classes which he recognizes, curves for stand height, c.a.i., average annual outturn, volume, basal area, diameter and stems/ha. for a 100-year rotation. He also includes a sawlog scaling table (with figures adjusted to give the customary overrun), and compares the yield by assortments and the economies of growing Scots Pine and Norway Spruce in this district and in Denmark generally, concluding that Spruce definitely has the advantage on sites of (Spruce) quality classes 1-5, and that Pine should not be grown on such sites unless other considerations, e.g. fungus attack, windfirmness or aesthetic reasons, intervene.

769. EYTINGEN, G. R. Výchivaemost' derev'ev v lesu. [Survival of trees in the forest.] *Agrobiologiya* 1949 (1), (55-74). [Russ.] [Sel'skokhozyaystvennaya Akademiya im. K.A. Timiryazeva, Moskva.] H.S.B.

Data from permanent sample plots in various natural stands and plantations in the Timiryazev Agricultural Academy's experimental forest, remeasured at 3- to 5-year intervals and subjected to no fellings except removal of dead and dying trees, have been studied to elucidate growth changes and survival. The trees were numbered and their size and distribution repeatedly recorded in scale plans for each plot.

The present paper deals with a natural Scots Pine stand aged 95 (93-101) years in 1946, with a natural underwood of Oak of medium density and not half the height of the overwood. Here a sample plot was established in 1888, and the data for this, which are tabulated in

some detail, show that in the subsequent 58 years the mean diameter of living Pines increased 1.8 times and its coefficient of variation decreased 1.4 times; while the ratio of maximum diameter declined from 4.3 to 1.9, i.e. the relative variation of the extreme diameters decreased 2.3 times. The small-diameter trees showed greater accession of growth than the large ones, e.g. the minimum diameter in 1946 was 2.9 times that in 1888, while the corresponding figure for the maximum diameters was only 1.3.

Peak mortality occurred at 48-57 years of age. Studies of the periodic scale plans of the plot revealed the existence of groups of interdependent trees. 'For each such group the mean distance from the large-diameter tree to the nearest trees of smaller diameter was determined from the plan' for each remeasurement. It was found that with increasing age the number of such smaller trees decreased, with a natural increase in the mean spacing from 3.7 m. to 6.7 m. in the second half of the life of the stand. In spite of this the minimum distance from large trees to their nearest neighbours remained constant at 1 m., whereas the maximum distance increased over the half-century from 10 to 15 m., i.e. trees at some distance from a large tree tend to die while closer neighbours survive to maturity. The stand therefore tends to develop a group structure with clusters of trees in which survival is good, an effect pointed out by Lysenko on seeing the scale plans in 1947. This phenomenon, it is claimed, explodes the belief that density is the cause of mortality of trees in woods, and emphasizes the need to explore more fully the possibilities of group arrangements in raising forest stands. The question is also approached from the opposite direction by analysing the situation of trees of low survival. In the second half of the life of the stand the number of live Pines surrounding dead ones was about halved and their mean distance from the dead trees increased from 4.1 to 6.4 m. During the same period the total mortality was 921 trees/ha., the mean diameter of which increased 2.6 times (from 12.9 to 29.6 cm.) over the period, while that of the survivors increased 1.6 times (from 19.4 to 30.9 cm.).

770. BRIEGLEB, P. A. The yield of Douglas-Fir in the Pacific Northwest measured by International $\frac{1}{4}$ -inch kerf log rule. *Res. Notes Pacif. Northwest. For. Range Exp. Sta.* No. 46, 1948. pp. 4.

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

60.2. *Management of Tree Plantations under Non-forest Conditions*

771. COUPPIS, T. A. **Village fuel areas in Cyprus.** *Emp. For. Rev.* 28 (1), 1949 (25-32 + 8 photos).

A start was made in 1942 on the creation of village fuel areas in Cyprus, and by the end of 1947, 74 such areas had been created and nearly 3,000 acres of plantations successfully established at a cost of £48,000. The principal species used are *Acacia cyanophylla*, *Eucalyptus gomphocephala*, and *E. tereticornis*, which are fast growing and coppice freely. *Cupressus sempervirens* is also planted for production of roofing poles, and the slower growing *Ceratonia siliqua* is also used on calcareous soils not only for fuel but also for pods for animal fodder. The scheme has also encouraged private planting of derelict land with planting stock made available in Government nurseries.

The actual establishment of village fuel areas is carried out by the village authorities under advice and supervision from Government forest staff. Subsequent maintenance and protection of the plantations are the responsibility of the village, and revenue from the sale of fuel is paid into the village fund. *From author's summary.*

61. SURVEYING. MAPPING

772. HASEL, A. A., and POLI, A. **A new approach to forest ownership surveys.** *Repr. from Land Economics* 25 (1), 1949. pp. 10.

In connexion with the forest survey of California, the line-sampling method was adopted for estimating acreage and number of owners by class of ownership. Tests based on comparison of 42 sample estimates with the known true areas in an area of $1\frac{1}{2}$ million acres indicated that estimates were unbiased and that the sampling data provided an adequate basis for estimating sampling error. Work completed on 8 million acres indicates that the cost of collecting data is reduced to less than $\frac{1}{2}$ of that required by the usual complete inventory. The possibility of using similar sampling

methods for land-utilization surveys is suggested. *From authors' summary.*

773. ČOKL, M. K inventarizaciji gozdov. [On forest surveys.] *Gozd. Vestn.* 5 (3), 1946 (49-52). [Sloven.]

Stresses the need for a fresh inventory of the forest resource in Slovenia, at least in the larger forest estates which can supply markets on a sustained basis. Recommends photogrammetry as the best method, when equipment is available.

774. NOYON, F. Méthode pratique de topographie forestière à l'usage des chefs de chantiers et contremaîtres pour le relevé d'itinéraires de sondages en forêt tropicale. [A practical method of forest surveying for the use of foremen and overseers in recording survey routes in tropical forest.] *Bois For. Trop.* No. 8, 1948 (371-8). [F.]

Describes with diagrams a chaining method using compass and clinometer, giving a specimen record page, and an explanation of the trigonometry involved.

775. STEVENS, D. R. **Photographing cut-over areas.** *Woodl. Sect. Index Can. Pulp Pap. Ass.* No. 1004 (A-2-b), 1949. pp. 4. Also in *Pulp Paper Mag. Can.* 50 (5), 1949 (146, 148, 150, 152).

The Brompton Pulp and Paper Co., Nipigon, Ontario have for some years been doing their own photographing of cut-over areas, using a hired plane instead of contracting the work. The cost is substantially less and the work can be done at the time most convenient to the company. The method consists in photographing the various cuts, outlining their boundaries on the prints, and then transferring them to maps. The type of plane, camera, film etc. used are discussed, together with methods and times of photographing, mapping etc.

776. STOVER, W. S., and BURKLE, J. L. **Million-acre cruising.** *Sth. Lumberm.* 177 (2225), 1948 (147-9).

A brief account of methods used in the Southern Forest Survey. Aerial photographs are examined and a count and classification (as forest or non-forest land) is made of dots

spaced at about one in 330 acres. The location of sample plots for ground cruises is then determined by means of a grid. In the sample plots, which are selected in pairs, timber cruisers tally and classify trees by merchantability, species and diameter, and the merchantable length and form of merchantable trees is recorded. An appraisal of quality is also given. The acre surrounding the plot is then surveyed and classified as to forest type, stand size and quality, and degree of stocking. At the Southern Forest Experiment Station Headquarters, data are compiled from these records with the aid of electric accounting machines.

777. SEGEMARK, K. R. Flygfotograferings-säsongen, några synpunkter med avseende på skugglängd och ljusbetingelser. [The aerial photography season: notes on shadow length and light conditions.] *Skogen* 36 (3), 1949 (35-6). 1 ref. [Sw.]

Contains a table showing for Sweden (and having regard to the photographic equipment used there) the daily period suitable for aerial photography, in clear weather, at 5-day intervals from April-Sept., for latitudes of 55-66° N. and assuming the limiting altitude of the sun to be 33-9° (shadow length 150% that of the object casting the shadow); also a sketchmap showing variation in local time and approximate dates for the disappearance of snow in spring. Where minutes are precious it may be possible to find the limiting value of the sun's altitude, for a given set of conditions, by the results of test photographs taken at suitable intervals as the sun sinks.

778. SEELY, H. E. The forestry tri-camera method of air photography. *For. Air Surv. Leaf. For. Serv. Can.* No. 3, 1948. pp. 11 + 4 dgms.

Includes specifications and some indication of costs, as well as a description of the method and its advantages. [Cf. *For. Abstr.* 10 (No. 1497).]

779. ROGERS, E. J. A short cut for scaling aerial photos. *Sta. Pap. Ntheast. For. Exp. Sta.* No. 20, 1948. pp. 10.

The method described involves selecting 10 photos at random from a big project, and computing average scale at sea level for the entire project. From this average scale, adjustments can be made for different elevations.

780. HUTCHISON, O. K. Aerial photo alignment guide. *Sta. Notes Cent. St. For. Exp. Sta.* No. 50, 1948. pp. 2.

Instructions for making and using a guide for locating the principal point of an aerial photo and aligning the photos of stereo pairs.

781. ROGERS, E. J. Estimating tree heights from shadows on vertical aerial photographs. *J. For.* 47 (3), 1949 (182-91). 3 refs.

Detailed instructions for orienting photos, use of the wedge or pole scale for measuring shadows on photos, and conversion of shadow length to tree height. The more serious errors can be avoided or greatly reduced by the following precautions:—Shadows on slopes should be avoided; all shadows measured should be located on flat or nearly flat land surfaces. The presence of gullies and knolls is often concealed by crown canopy, but with experience it is possible to deduce their presence from photographs, e.g. if a group of large-crowned trees occurs in the midst of small crowns while all heights appear to be the same, it may be suspected that the former are growing in a depression.

Trees for measuring should be selected from those whose shadows lie on the ground. The height of trees whose shadows lie on underbrush or snow will be underestimated because the shadow is shortened. If such shadows must be used, the depth of snow or height of brush must be estimated and added to the tree height obtained from the shadow.

Large-grown, open-crowned trees tend to have long shadows; the shadow tip is produced by a side branch, and not by the top of the tree. Leaning trees are not a serious source of error, since most trees are comparatively straight, but the shadows of trees leaning towards the sun tend to be slightly shortened, and those leaning away from it to be slightly lengthened. Care is needed in studying tree shadows near the edges of aerial photos, owing to the progressive displacement as one gets away from the principal point.

782. SEELY, H. E. [Symbols for description of growing stock on maps or air photos.] *For. Chron.* 25 (1), 1949 (62-5).

The Committee of Surveys Research of the Canadian Society of Forest Engineers, has recommended the use of the following symbols.

Type to be represented by the letters H for hardwood, S for softwood, and M for mixed. Arabic numerals for height classes, starting with 1 for 0-5 ft., 2 for 6-15 ft. and then by 10-ft. intervals. If 5-ft. classes are required, the use of subscripts is advocated, e.g. 2₁ would indicate the 6-10 ft. and 2₂ the 11-15 ft. class. Density to be shown by capital letters, A = 6-15%, B = 16-25%, and so on to J = 86-100%; age classes by roman numerals I = 0-15 years, II = 16-25 etc. For site, symbols as follows:—U = ridge top, V = upper slope, W = lower slope, X = moist flat, Y = dry flat, and Z = wet flat.

783. FOCAN, A., and MULLENDERS, W. Communication préliminaire sur un essai de cartographie pédologique et phytosociologique dans le Haut-Lomami (Congo Belge). [Preliminary report on an experiment in pedological and phytosociological mapping in the Haut-Lomami (Belgian Congo).] *Bull. agric. Congo belge* 40 (1), 1949 (511-32). 17 refs. [F.]

784. DOMMERGUES, V. L'exécution de la carte forestière de la province de Fianarantsoa. [Making a forest map for the province of Fianarantsoa [Madagascar].] *Bull. agric. Congo belge* 40 (1), 1949 (97-108). [F.]

63. ROTATION

785. **Exploitable size and age of *Bombax malabaricum*.** *Rep. For. Res. C. P. & Berar* 1947, 1948 (5-9).

Analysis of the available (rather scanty) data indicates that in the Central Provinces the proper exploitable age in better-quality forests should be 90-100 years, and in drier forests of lower quality, 65-70 years; the corresponding girths are 7 ft. and 4 ft. 6 in. respectively.

7. FOREST ECONOMICS, VALUATION, AND FINANCE

See also *For. Abstr.* 11 (Nos. 101, 207, 209, 229, 248, 253, 273, 277, 281, 373, 376, 383, 393, 397, 604, 768).

789. DUERR, W. A. **The economic problems of forestry in the Appalachian Region.** Harvard University Press, Cambridge, Mass. 1949. pp. xii + 317 + 7 plates. Price \$5.00.

The book aims at defining the field of the economics of forestry and outlining the

64. DESCRIPTION OF SITE.

ASSESSMENT OF SITE AND STAND QUALITY

See also *For. Abstr.* 11 (No. 658).

786. STAEBLER, G. R. **Use of dominant tree heights in determining site index for Douglas Fir.** *For. Res. Notes Pacif. Northwest. For. Range Exp. Sta.* No. 44, 1948. pp. 3.

787. BARNES, G. H. **Site classification for even-aged stands of Western Hemlock.** *Res. Notes Pacif. Northwest. For. Range Exp. Sta.* No. 50, 1949. pp. 7.

65. DESCRIPTION OF GROWING STOCK

See *For. Abstr.* 11 (Nos. 198-9, 782).

66. YIELD REGULATION. SUSTAINED YIELD

788. PATRONE, G. Una nuova formula per il calcolo della ripresa. [A new formula for calculating possibility.] *Ital. for. mont.* 4 (1), 1949 (35-40). [It.]

Schaeffer in 1905 published an amendment of Masson's method for the calculation of possibility (division of the growing stock by half the duration of the rotation), incorporating the factor of site quality, and worked out the requisite coefficients for the Fir forests of Savoy. The present author further develops the formula, including the following factors: mean age of the tree of merchantable size, mean age of trees above this size (excluding trees of exceptional dimensions), volume of the normal growing stock by diameter classes from 25 cm. upwards, volume of trees of classes larger than the merchantable size.

economic problems of forestry as background for research. It deals specifically with the Appalachian region in and about 1940, but the analysis of regional forestry problems serves as an approach to wider theoretical issues. The introduction deals with the field of forestry economics and the nature of its problems.

Chapters deal with the forestry problems of the Appalachian region; of people and land; forest-land management; timber management; general marketing; marketing pulpwood and allied products, sawmill products and miscellaneous products; and the consumption of forest products. The appendix gives definitions of forestry economics and estimates the position occupied by timber production in the economy of the Appalachian states.

790. FRANK, B. **Valuation of forest lands from the public viewpoint.** *Unasylva* 2 (2), 1948 (54-62). 8 refs.

Discusses general principles of valuation and stresses the need for taking into account questions of flood control, erosion, sedimentation, amenity etc. in valuing forest land, and the inadequacy of ordinary commercial methods of valuing.

8. FOREST ADMINISTRATION

81. ORGANIZATION

791. Numéro special consacré aux Eaux et Forêts, et au tourisme cynégétique et halieutique. [**Special number devoted to the French forest administration, hunting and fishing.**] *Rivières et Forêts, Paris* No. 10/12, 1949. pp. 66. [F.]

A special number of a periodical usually devoted to hunting and fishing, dealing with the organization and work of the Administration des Eaux et Forêts, French forests, and hunting and fishing in them.

792. MILWARD, R. C. **The Indian Forest Service: its origin and progress.** *Unasylva* 3 (1), 1949 (14-22). 5 refs.

82. LABOUR QUESTIONS

793. LUTHMAN, G. Yrkesundervisningens ordnande inom skogsbruket. [**The organization of workers' training in forestry.**] *Skogen* 35 (16; 17), 1948 (183-4; 197-8). [Sw.]

Briefly reviews Swedish efforts towards the rationalization of manual work in the forest, with special reference to developments in tool maintenance, physiological studies and the practical organization of training. It is impracticable, in the region with which V.S.A. (*Värmlands Skogsarbetsstudier* [the Värmland Forest Work Studies Organization]) has to deal, to give training courses to large numbers of workers. This organization therefore aims at training a sufficient number of under-instructors (*instruktörsbiträden*) to leaven the corps of workers engaged in forestry operations in the field. Separate under-instructors are trained for felling operations and for timber extraction (including road works). Both types receive a basic training course (the former of 2

weeks, the latter of 6 days), followed by about 6 months' practical experience and then by a week's continuation course. The establishment of periodic refresher courses is also envisaged. The work of the under-instructors is normally supervised by the forest officer and rangers on the spot. Two large forest companies have appointed special chief instructors to direct their activities; in the remaining enterprises associated with the scheme technical supervision and aid is also afforded by special travelling inspectors provided by V.S.A.

The scheme, started in 1945, is expected to be fully developed in 1949. Results so far have been promising.

794. BILLMANN, H. H. Skovbrugets Arbejds-kraft. [**Manpower in forestry.**] *Dansk Skovforen. Tidsskr.* 38 (11), 1948 (520-43). [Dan.]

Reviews present labour conditions in Danish forestry, with suggestions on means of attracting and training young recruits to forestry work.

795. HVIID, A. Den lønningsmæssige Udvikling indenfor Statsskovvæsenet fra 1931 og indtil dato. [**Wage movements in the Danish Forest Service from 1931 to date.**] *Dansk Skovforen. Tidsskr.* 34 (1), 1949 (1-5). [Dan.]

796. WADSWORTH, F. H., and SOLÍS, E. **Population and employment problems in the Toro Negro forest.** *Carib. For.* 10 (1), 1949 (59-80). 5 refs. [E.Span.f.]

Describes briefly the history of the Toro Negro forest and the problems arising during the course of attempts to develop it. When purchased by the Puerto Rican government in 1935, the forest was in a degraded state, much

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of the accessible timber having been cut, lands deforested where non-paying coffee plantations had been abandoned, and the soil fertility reduced by erosion and leaching. A 'taungya' system of reforestation was inaugurated by the government, but many plantations failed because of insufficient knowledge of species adaptability. Finally the war and the termination

of the Civilian Conservation Corps put an end to the plan. In 1943 the government took action to establish permanent farms under certain controlled conditions. The author discusses problems of the transition and the advantages and difficulties of maintaining a small population of settlers within the forest to provide a source of forest labour.

9. FOREST POLICY

90. GENERAL PRINCIPLES OF FOREST POLICY

See also *For. Abstr.* 11 (No. 35).

797. VOGT, W. **The population of El Salvador and its natural resources.** Pan American Union, Washington, D.C. 1946. pp. 30.

798. VOGT, W. **The population of Venezuela and its natural resources.** Pan American Union, Washington, D.C. 1946. pp. 52.

91. SOCIAL AND ECONOMIC INFLUENCE OF THE FOREST. NATIONAL PARKS. RESERVES. FOREST INFLUENCES

See also *For. Abstr.* 11 (Nos. 789-91, 796).

91.1. *Rural Preservation. Reserves. National Parks. Plant and Animal Protection*

799. FOGGIE, A. **Forest reservation in the Gold Coast.** *Bull. agric. Congo belge* 40 (1), 1949 (677-88). [E.]

800. DUGUAY, J. Un exemple d'aménagement faunique dans la province de Québec: le castor. [An example of management of forest fauna in Quebec: the beaver.] *For. québec* 14 (5), 1949 (315-23). [F.]

Cf. *For. Abstr.* 11 (No. 691).

91.3. *Influence of the Forest on the Environment*

See *For. Abstr.* 11 (Nos. 42, 45-50, 134, 294-6).

92. FOREST LAW

See also *For. Abstr.* 11 (Nos. 54, 809).

801. **Memorandum on the preservation of trees and woodlands (including model form of Tree Preservation Order).** Ministry of Town and Country Planning, London. 1949. pp. 28. H.M. Stationery Office, London. Price 6d.

802. Opći zakon o šumama. [The new] general forest law [of Yugoslavia]. *Šum. List* 72 (1), 1948 (23-30). [Croat.]

803. **The statute laws of Cyprus, No. 36 of 1948. A law to amend the Forest Law, 1939.** Govt. Printer, Nicosia. 1948. pp. 2.

804. **Forests: Chapter 105 of the laws, 1939 edition.** Govt. Printer, Lusaka, Northern Rhodesia. 1948. pp. 41.

805. **Bush fires: Chapter 107 of the laws, 1948 edition.** Govt. Printer, Lusaka, Northern Rhodesia. 1948. pp. 8.

806. **Louisiana forest laws.** *Bull. La. For. Comm.* No. 2, 1947. pp. 97. With revised supplement, 1949. pp. 7.

807. **The revised laws of Sarawak. Title VII. Forestry and agriculture; game and fisheries.** Govt. Printing Office, Sarawak. 1947 (275-322).

808. **No. 518 Order No. F-1 (Forests) 1934: Forest Rules, 1947.** Director of Forestry, Kuching [Sarawak]. 1947. pp. 6.

94. FOREST OWNERSHIP. CO-OPERATIVES

See also *For. Abstr.* 11 (No. 772)

809. HUBER, A. **Der Privatwald in der Schweiz.** [Private forests in Switzerland.]

Verlag Leemann AG., Zürich. 1948. pp. 331. 238 refs. [G.g.f.e.]

A monographic study, with chapters on:— the legal basis and origin of the term 'private forest'; the size and distribution of private forests in Switzerland; legal restrictions on private forests; economic importance; present condition and the factors contributing thereto; and ways and means of improving the yield, with special reference to possible solutions of the problem of managing small scattered lots of forest.

810. WILSON, S. A., and MALONE, P. E. **Instability of forest land ownership in Western Oregon and Washington 1932-1941.** *Res. Pap. Pacif. Northwest. For. Range Exp. Sta.* No. 1, 1948. pp. 57.

96. POLICY REGARDING PROTECTION FOREST, DEFORESTATION AND AFFORESTATION

See also *For. Abstr.* 11 (Nos. 28, 53-4).

811. [Planting programme.] *Rep. For. Dep. Kenya 1945-7, 1949* (27-8).

The programme recommended by the Development Committee includes the planting of 6,000 acres a year of rapidly growing softwoods. The Forest Department proposes the following measures to carry this out:—(1) The recruitment of specialist officers whose main duties will be to see that they are grown on suitable soils and protected from insects and fungi. (2) Half the acreage to be planted with Cypress species and half with other softwoods of short (35-40 years) or medium (60-80 years) rotation. (3) The Cypress should be grown either in mixtures, in areas where mixture trees will grow at much the same rate as Cypress, or in pure stands. In the latter case, the blocks of plantation are not to exceed 100 acres in extent, and are to be separated from adjacent blocks by belts up to 100 yards wide, either of broadleaved natural forest or of planted indigenous softwoods such as *Polyscias kikuyuensis*. (4) In every really extensive plantation area, there should be left at convenient intervals, in addition to the small protection belts mentioned above, stretches of forest a mile or two miles wide, worked permanently under the selection system.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

See also *For. Abstr.* 11
(Nos. 42, 44, 789, 796).

812. KUNNHOLTZ-LORDAT, G. *La silva, le saltus et l'ager des garrigues.* [Forest, pasture and arable land of the garigue.] *Annales de l'École nationale d'Agriculture de Montpellier* 26 (Fasc. 4), 1945. pp. iv + 83 + 1 dgm. 61 refs. [F.] I.I.E.

This report, which was compiled by the Commission 'Exploitation de la Garrigue', consists of a study of the 3 fundamental factors of rural economy, forest, pasture and arable land, and of the formation of the 'garigue' in France and its position in the economic life of the country. Some general recommendations for exploiting the 'garigue' are included.

813. EGGELING, W. J. **Land utilization with special reference to forestry.** *Emp. For. Rev.* 28 (1), 1949 (38-42). 11 refs.

Ideally, production and protection forests should occupy about 25% of a country. In Uganda, circumstances prevent more than 8-9% being reserved. This limited area must be chosen to the best advantage in relation to other claims: it cannot consist entirely of waste and marginal land. Reservations should be made early, using natural boundaries (e.g. rivers) for protection, and leaving the final areas and boundaries for later decision under planned land-utilization policies. These major reservations are of little direct help to the peasant farmer, who needs a clump of trees near by for his fuel and building poles and for shade. Figures obtained in the Kigezi area suggest that these 'farm forests' should occupy about 4-5% of the land in farm use. About half should be in clumps near the houses, and the remainder in communal plots on marginal and steep land, forming windbreaks and contoured wash-stops. *From author's summary.*

814. AUGUSTIN TOSANTOS, M. **Consideraciones forestales de Guipúzcoa.** [Forest problems of Guipúzcoa.] *Montes, Madrid* 5 (25), 1949 (61-2). [Span.]

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The regression of the native deciduous species of Guipuzcoa (Oak, Beech and Chestnut) is due partly to the custom of pollarding them for fuel and other products for the farms (the firewood belonging by tradition to the tenant and timber to the landlord), and partly to the introduction of the quick-growing *Pinus*

radiata. The author believes that it would be advantageous to preserve the native species and manage them as high forest for timber production. *P. radiata* should continue to be grown, but the native species should follow it after 2 rotations (60 years), when an improvement in the soil has taken place.

FORESTRY THE WORLD OVER

References: 1. *Annual Report of H.M. Forestry Commission*, 1948, London. 2. *Chemical Age*, London. 3. *Chemical and Engineering News*, Washington. 4. *Empire Forestry Review*, London. 5. *F.A.O. Leaflet*, Washington. 6. *Foreign Commerce Weekly*, Washington. 7. *Forêt québécoise*, Quebec. 8. *India News*, London. 9. *Journal of Forestry*, Washington. 10. *Maderil*, Buenos Aires. 11. *Malayan Forester*, Kuala Lumpur. 12. *Montes*, Madrid. 13. *News Bulletin*, Canadian Pulp and Paper Association, Montreal. 14. *Revue internationale du Bois*, Paris. 15. *Sunday Times*, London. 16. *Times*, London. 17. *Unasylva*, Washington. 18. *Weekly Pakistan News*, London. 19. *West Coast Lumberman*, Seattle. 20. *Woodworking Industry*, London.

Conferences. The African Conference on Soils was held at Goma (Belgian Congo), 7-16th Nov., 1948. The following are the most important recommendations:—(1) The establishment at Paris of an African Information Bureau on Soil Conservation and Use. (2) The establishment of a research centre for promoting methods of soil analysis best suited to African conditions, determining uniform procedures for study, classification, and mapping of soils, and arriving at an agreed system of terminology and nomenclature. (3) The setting up of permanent regional committees on soil conservation and utilization (17; March-April 1949).

Discussions at a symposium on wood, held at Washington 16-17th June, and organized jointly by the National Research Council and the Office of Naval Research, covered the chemistry of the Redwoods, the structural relationships of the constituents of wood, the chemistry and uses of Douglas Fir bark, the conversion products obtainable from wood by chemical and physical means, and the mechanical properties and biological deterioration of wood (3; 27.6.49).

The following conferences were to be held during 1949:—

International Conference of Plant Breeders, Paris, August.

European Forestry and Forest Products Commission, Geneva, September.

E.C.E. Timber Committee, Geneva, September.

Committee on Unexploited Forests. Probably Havana, November (15; 15.5.49).

Australia. The N.S.W. legislature has recently passed an act setting up a central conservation authority, to consist of two members of the Water Conservation and Irrigation Commission (one of whom is appointed Chairman), the Forestry Commissioner, and the Director of the Soil Conservation Service, and the head of the Department of Conservation (4; Sept. 1949).

Burma. Unrest continues to hamper the production of Teak, and has resulted in the complete nationalization of Burma's forests more than a year in advance of the original date set by the Government, which was June 1, 1950. The Teak Consortium, composed of the European firms operating in the forest, has been dissolved. All the elephants, equipment, and property of the lessees will go to the Government. In return, the companies which plan to continue sawmill operations at Rangoon will receive title to exploit about 50,000 tons of Teak. Negotiations for compensation are continuing with the other lessees. The movement of logs down the Irrawaddy River has become very hazardous and difficult. Late in November, 32,000 logs were floated down the river from Pakkoku, escorted by two Burmese Navy gunboats. After a hazardous trip of 10 weeks, the logs reached Rangoon at the end of January. These logs were expected to keep the Rangoon sawmills operating at half capacity until April (6; 27.6.49).

Canada. The Southern Canada Power Co. began its work of afforestation in 1926 by planting a few trees to improve the appearance of the land surrounding the electrical installations. By 1933 the company was planting 8,500 trees annually, and by 1948, the figure had risen to 89,000, including Norway Spruce, Black Spruce, Red Pine and Birch. The growth of the undertaking necessitated the purchase of whole farms and the company decided to afforest them to prevent erosion. An area of 55,000 acres is now devoted to forestry (7; May-June 1939).

Denmark. A new plant being constructed at Pinderstrup, Denmark, is to manufacture a block-board, called Novopan, from wood-waste of sawmills, veneer plants, and planing mills. The factory, with an estimated annual production of 12,000–13,000 cu.m., will manufacture boards ranging from 8 to 40 mm. in thickness and up to 4.25 sq. m. in area. The material weighs 450–600 kg./cu.m. The surface layers of Novopan will be made from shavings, and the core from other wood wastes. By the application of high temperature and pressure, a smooth board with a figured finish will be produced (6; 30.5.49).

Ecuador. A Department of Forestry, subordinate to the Ministry of Economics and Agriculture has recently been created (10; April 1949).

France. According to official figures, the losses caused by the forest fires in the Landes in August were 339,000 acres of woodland burnt, representing 69 million cu. ft. of timber, and 443 houses and other buildings destroyed. These losses are valued at 5,000 million francs (about £5,000,000). Eighty-four persons lost their lives, 100 were injured, and 269 families were made homeless (16; 13.9.49).

A committee of inquiry into the deaths of 84 fire-fighters in the Landes on 21st August, during the forest fires there, has found that the cause was 'an unusual cyclonic disturbance'. The fire-fighters were engaged in controlling a counter-fire. This was completely under control and in some places had already been put out. Where the main fire had reached the fire-break, it was burning itself out. Suddenly, however, a whirlwind swept through the critical area, scattering burning twigs over untouched parts of the forest, fanning the embers into a blaze, and lashing the men with tongues of flame. They tried to escape, but found themselves caught between the main fire, their own counter-fire, and the new fires that were springing up all round. Three separate groups were overwhelmed almost at the same moment and apparently in the same way. A fortnight after the event, the trees in the path of the whirlwind were found to be uprooted or inclined at an angle. Some of the Pines had their bark partly scraped off by the whirling sand; their branches had been stripped of needles. The cyclone, which travelled from S.W. to N.E., was observed by persons many miles from the fire (16; 12.9.49).

Great Britain. The census of all woodlands of 5 acres and over was started in 1947, and by the end of September 1948 the field survey of the whole of Scotland and Wales had been completed, and good progress made in England. The census disclosed a total area of 1,024,000 acres of privately or corporately owned woodland in Scotland and 224,000 acres in Wales. Of this woodland, the proportion classified under the combined heads of felled, devastated and scrub, was 64% in Scotland and 47% in Wales; the corresponding figure for England is provisionally estimated at 33% (1; 1949).

In spite of drought and an exceptionally hot summer, fires in state forests have been less numerous than they were last year. Nevertheless, nearly 1,000 outbreaks on or near the Forestry Commission's plantations have destroyed 470 acres of young woodland and done damage estimated at £20,000. In the year ended 30th Sept. 1948, there were 1,189 fires, which affected 1,837 acres and caused damage amounting to £45,000. In the current year, the Forestry Commission is spending £169,000 on fire protection, compared with £155,000 last year. That sum covers the ploughing of fire rides, the maintenance of fire patrols and the cost of extinguishing outbreaks. During the danger period, the Commission's 500,000 acres of woodland are guarded from watchtowers equipped with plotting maps and in communication with mobile fire-fighting forces (16; 17.9.49).

The Forestry Commission have announced the following changes in the Dedication Scheme:—The planting grants under Basis II will be increased from £10 to £12 per acre, and the maintenance grants from 3s. 4d. to 4s. per acre. Provision will be made for release of woodlands from dedication in the case of small detached blocks; also where the owner is unable to continue effective management and the Commission does not consider it desirable to take over management or to acquire. Under Basis II, all obligation to keep accounts will be withdrawn. The United Kingdom Private Forestry Committee have undertaken to assist by providing details of accounts for analysis as is now done in the case of farm accounts. Provision will be made for the appointment of an independent investigation committee to advise the Commissioners in any case of dispute arising under the scheme as to

whether forest operations have been satisfactorily carried out. Arbitration is already provided for any other type of dispute (4; Sept. 1949).

Local infestations of *Ips sexdentatus* have occurred at different places in South Wales. These bark beetles have been brought into the vicinity of plantations in mining timber imported from France. Prompt measures of felling the infested trees and removing the bark, were taken, and serious outbreaks have not developed (1; 1949).

A new insecticide called Pestox 3 has been produced by Pest Control Ltd. of Bourn, Cambridge. It has a phosphorus base and works by absorption into the sap system of the plant, the whole of which is for a period rendered poisonous to sucking insects. It can be absorbed through the roots, but it is also readily absorbed by the leaves, and this seems to be the most practical method of applying it. The pest against which it has so far chiefly been tried is the hop aphid, with most encouraging results. Preliminary experiments on other plants have been carried out this year. These have achieved a diminution of 50% in the sugar-beet yellow virus, which is transmitted by aphid. Tests have been made which show that not enough of the chemical remains in the hops to do any harm to consumers of the beer made from them (16; 8.9.49).

A scheme for the development of the pulp industry in the north of Scotland is being sponsored by the Mugiemoor paper mills, subject to authority being given by the Government to import machinery from the U.S.A. The plant would use wood-waste and thinnings from Scottish forests and would provide pulp for the paper industry in the north-east (2; 15.1.49).

A new type of helicopter blade for the helicopter WII (the Warhorse) is made entirely of wood. It is a pure monocoque blade built on the egg-shell principle without ribs, so that all the strains and stresses are contained in the outer skin. The leading edge is of compressed wood, and the moulded skin of Canadian Birch with a core of African Mahogany (20; Oct. 1948).

India. The Central Ministry of Agriculture has suggested to all Provincial and State Governments that tree planting should be a feature of the second Independence anniversary celebrations. A two-week tree-planting drive was launched by the United Provinces government on 15th August. The target for the district of Dehra Dun alone, is 50,000 trees of all kinds. The horticulture department is planting 1½ million trees, mainly fruit trees, in the rural areas by the end of the year. During the last two years, the department has planted 2,223,241 trees and made 2.8 million tons of compost. Irrigation facilities were provided to 58,000 acres of land (8; 23.7.49).

The Madras Government has approved a plan suggested by the Government of India, to plant 15,274 acres of land in the upper Palnis with Wattle trees on a 10-year rotation, in order to replenish the supply of Wattle bark, which is no longer being imported from South Africa (6; 1.8.49).

Israel. Immediately on the declaration of the state, the government of Israel created the post of Conservator of Forests under the Ministry of Agriculture, with headquarters at Haifa. The department is working with a much reduced staff, most of the younger officers of the Jewish staff being in the defence army. Of the Arabs, any who have remained in the country have been re-employed. Demarcation work is proceeding as usual. A large nursery has been established at Qadima, near Nathanya, to meet the needs of the department and for free distribution of plants to the public. Efforts are being made to establish at Qadima a national arboretum. A comprehensive library is being built, and copies of all publications on forest matters that are normally distributed would be welcomed by the Conservator of Forests of the Government of Israel, P.O.B. 88 Nathanya (4; June 1949).

Jugoslavia. Four forest research institutes came into being in 1948 in the several federated republics of Jugoslavia, with headquarters in Belgrade, Zagreb, Ljubljana, and Skopje. They are under the direction of the forest departments of the respective republics. In addition there is an All-Union institute, with headquarters in Split, devoted to the development of improved methods of forestry on rocky soils (17; July-Aug. 1949).

Last year, 306 million plants and 1½ million kg. of forest seeds were used in reforestation operations in Jugoslavia. This year it is intended to afforest more than 50,000 ha. of calcareous soils and about 100,000 ha. of cut-over land. It is also intended to construct 198 km. of forest roads and 69 km. of forest railways in Serbia alone (14; May 1947).

New Zealand. Plans to employ the Royal New Zealand Air Force on the re-fertilization of 10 million acres of hill country are being examined by the N.Z. Government. Experiments already made in the top-dressing of hill land with pellets of superphosphate discharged from aircraft suggest that meat production, in particular, can be increased by 20%. They also show that aerial dressing on a big scale should be cheaper than any other means and is so effective that it would need repeating not more often than every 3 or possibly 5 years. Supplies of superphosphates available in N.Z. for this purpose seem likely to set a limit of 750,000 acres annually for treatment under the scheme. If aircraft of the Hastings type with a 10-ton capacity are used, 15 are likely to be needed for this annual task (15; 10.7.49).

C. F. Gardner of Auckland is about to take out patents in Canada and the U.S.A. for a wood-panel construction especially adapted to roof and wall building. The principle of construction consists in fitting steam-curved wood sheets or hardboards into a frame of lumber, the edges being secured in grooves sawn into 2 x 2-in. stock which is fastened to the frame by nails or screws, and held in place by cross-pieces. Both the Government Housing Department and the Wellington city council have approved and are using 'Gardner construction' (19; June 1949).

Nicaragua. Under a Presidential decree of 31st Jan. 1949, a Nicaraguan Department of Forestry was created as a branch of the Ministry of Agriculture and Labour. The new department will have control over all forest conservation measures, the reforestation of all suitable lands in Nicaragua, and enforcement of existing forestry laws. It is planned to establish nurseries of forest trees in various parts of the country to supply planting stock for the reforestation programme. The department is also preparing a new forest map of Nicaragua (6; 20.6.49).

North Borneo. The Forest Department is considering a scheme for capturing and training wild elephants, and using them for transport and the extraction of timber. A rough census of elephants is being made; it is hoped to import experienced Karens from Burma to do the catching and training.

Local timber companies are going in for spraying logs at the stump as soon as possible after felling. This has been found very effective in reducing borer damage. The spray consists of a mixture of creosote-base solution (solignum at present) and diesel oil, applied with Four Oaks knapsack sprayers. It is expected that a mixture of creosote and diesel oil will probably replace the more expensive solignum (11; April 1949).

Pakistan. If the recommendation of the Pakistan Forestry Conference is accepted, forest research will be conducted by the Central Government in future, instead of by the provincial authorities [see *For. Abstr.* 10 (p. 440)] (18; 23.7.49).

South Africa. A wallboard mill expected to produce about 60 million sq. ft. of hardboard and insulation board annually, has been opened at Estcourt, Natal. The principal raw material will be waste Wattle wood left after the bark has been used for tanning extracts. About 60,000 metric tons are expected to be available per year from the Wattle industry at a price of about 25s. per ton. About 150 Europeans and 200 natives will be employed (6; 30.5.49).

A partial solution of the housing problem is the construction of houses of Wattle timber. A type of log dwelling developed in Natal satisfies modern building standards and requires no imported timber. It has the appearance of a Swiss chalet and can be built for less than half the cost of an ordinary brick house of the same size. This will provide an outlet for the timber left after using the bark for tanning extracts (6; 16.5.49).

Spain. Chemical investigation of a lichen, *Usnea barbata*, found on Pine in Soria, has shown that it contains substances having marked antibiotic properties. An acid, usnic acid, and another substance have proved effective against *Staphylococcus aureus* and species of *Mycobacterium* (12; May-June 1949).

Surinam. The construction of a large plywood plant in Surinam has now been completed [see *For. Abstr.* 10 (p. 441)] and plywood is being shipped to the Netherlands. It has been found that the supply of Baboon wood, on which production is principally based, is less plentiful than was

formerly believed, and the government has forbidden the shipment of Baboon-wood logs to the Netherlands, though they continue to go to U.S. veneer mills (6; 2.5.49).

Switzerland. The Swiss Wood Industry Association, the Swiss Association of Professional Timber Merchants, and the Swiss Association of Forest Economy, have created an autonomous mutual assistance fund, to be financed by a special contribution of 10 centimes per cu.m. by owners of public or private forests and 20 centimes per cu.m. by purchasers of rough logs. It is managed by a special Commission composed of representatives of the three associations, plus a representative of the Swiss Forestry Society, and presided over by the Inspector-General of Forests of the Confederation, who acts in an advisory capacity. One-third of the available money will be used in studying problems of forest economy, particularly the improvement and rationalization of forest exploitation and timber transport, and in seeking markets for wood products of lesser value. One-third is intended for the improvement and rationalization of the timber industry. The remaining third is to be devoted to matters pertaining simultaneously to forest economy, industry and timber trade (17; July-Aug. 1949).

U.S.A. W. J. Buckhorn of the Forest Insect Laboratory, Portland, Ore., has invented a line-throwing gun for use in marking treetops to guide aeroplane pilots in spraying operations. Using an 1873-model Army Springfield .45--70 calibre, a foot-long, 6-oz. brass projectile with string attached is fired from the sawn-off barrel over the top of the tree to be marked. Next the line is used to hoist a paint bomb made from a waxed-paper ice-cream container filled with paint in which a capped quarter of a stick of dynamite is placed. When electrically detonated, the bomb splashes paint over the treetop, making it readily visible (9; June 1949).

The Timber Engineering Co., Washington, D.C., is investigating the possibility of using for pulpwood the 45 million sleepers removed annually from U.S. railways. It is estimated that nearly 160 million cu. ft. of sound wood could thus be made available annually for pulping and other uses (13; June 1949).

U.S.S.R. Wood is still one of the most used fuels in the U.S.S.R. for industrial and domestic use. Nearly 50% of all the wood cut in the entire country is used as fuel. To relieve the railways of the burden of transporting firewood (e.g. 3-5 million cu.m. per annum for Moscow alone) the government is seeking to devise methods of transporting it by water. The mining of coal, burning shale, and peat is being stepped up, as well as the use of natural gas. While the total amount of wood burned is still very large, its relative position is altering: in the 1920's wood constituted 41% of all fuel used, to-day it is only 20% (17; May-June 1949).